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CEMA COMPUTER TECHNOLOGY SURVEYED IN WEST GERMAN STUDY

West Berlin FS-ANALYSEN in German No 3, 1982 (signed to press July 1982) pp 2-5, 9-79

[Article by Klaus Krakat, Research Office for All-German Economic and Social Problems, West Berlin: "The Development of Electronic Computer Technology in the CEMA Countries as Exhibited at the 1982 Leipzig and Hannover Fairs"]

[Text] Table of Contents

Summary

As a number of developments in recent years has shown, the electronic computer industry in the CEMA countries has been generally adapted to microelectronics. The main prerequisite for this was the specific build-up and expansion of the electronics industry from the end of the 1970s with, above all, strong government funding of microelectronics in the individual CEMA countries. A strong orientation to the technological level of the Americans and Japanese and the perception of all potentials for technology transfer have proved to be fundamental for the attainment of planning goals. Nonetheless, the development of electronic data processing in the majority of CEMA countries is stamped by their own different development strategies. Whereas, for example, the development in Hungary was defined by cooperative, licensing and delivery contracts with Western firms, the GDR preferred a more independent development, which, however, did not preclude the purchase of computer products from the West. The USSR has proven to be less important than the GDR: as numerous examples from the past have shown, the USSR uses every opportunity to purchase electronic equipment from the West. Only the stricter technology embarbo of the Reagan administration has further constricted West-East technology transfer. In spite of numerous developmental successes, the USSR is still behind the other CEMA countries, as shown by the presentation of new electronics products at the fairs in Leipzig and Hannover. The USSR was represented last year in Hannover by a modest exposition but was entirely absent here in 1982. The precise reasons for this apparent reticence are unknown.

If we were to take the presence of export companies and their activities at the fairs and the scope of the products presented at the fairs in Leipzig and Hannover as a scale for evaluating the capabilities of the CEMA countries, then the GDR and Hungary would be classified ahead of the USSR. Even countries like the CSSR and Bulgaria would also rank ahead of the Soviet Union.

1. Introduction

International fairs like those in Leipzig and Hannover provide an opportunity to report not only on the exhibits at the fairs but also on the general state and potential of the electronic computer industry of the exhibiting countries. In the meantime, in the CEMA countries a series of changes has arisen in the area of electronic computing engineering due primarily to microelectronics. In the range of products of the individual producers in CEMA, microcomputers or microprocessor-based products now predominate to various degrees. Integrated circuits are found in electrical consumer goods and generally determine the level of computer-based products. Following the Western trend, EDP in the CEMA countries "has moved closer to the job site," and thus for some time concepts of a workplace-related data processing have been the primary emphasis in the use of computer engineering. In accord with these new developments, the organization of the computer industry and its production program in the individual CEMA countries will be discussed below on the basis of the exhibits[1] presented at the Leipzig and Hannover Fairs this spring.

2. GDR and Hungary Define This Year's Capabilities of CEMA Countries in Leipzig and Hannover

If we take the presence of the export trade companies and their activities at the fair and the scope of the products offered by the CEMA countries at the fairs in Leipzig[2] and Hannover[3] as a scale for evaluating capabilities in the area of electronic computer technology, then the GDR and Hungary would rank ahead of the USSR, and even countries like the CSSR and Bulgaria would have to be classified ahead of the USSR. Regardless of their presence at the fair and fair exhibits, since about the beginning of the 1980s an increasing technology gradient[4] has been forming in CEMA in the area of electronic computer engineering. Many activities in research and development, general incorporation of the potentials of microelectronics and adaptation of production to Western developments have helped make both the GDR and Hungary the leading countries in the CEMA. In both countries, research, development and production within the frame of "Socialistic Economic Integration (SOI)" is not limited only to the completion of special tasks. Rather an industry was developed under the concept of a "concentration of forces," characterized by a general diversification of capabilities. In both countries, above all, the emphasis of production and the export program are necessarily different because of differing production conditions and development strategies. Whereas the development strategy of the Hungarian manufacturer of computer products is characterized by cooperation, licensing and delivery contracts with Western partners,[5] which smooth the way for sales of products to the West, the GDR prefers a completely independent development,[6] although the interest in Western technology continues to be large--according to some West German computer manufacturers--and Western development results continue to be the scale for their own development concepts. In spite of the different development strategies, the production of computer products was quite promising both in the GDR and in Hungary.

Although the USSR by its own admission has been producing integrated circuits since about 1961,[7] began series production of microprocessors after 1977-1978[8] and has been producing industrial robots for a long time[9] and now has a universal control system and is the largest computer manufacturer in the CEMA, at the fairs in Leipzig and Hannover there was nothing to be seen of the Soviet capabilities. The precise reasons for this apparent reluctance are not known. Perhaps the exposition of Soviet products in Western fairs and the export of Soviet electronics to Western countries are not considered very feasible because their own production can hardly meet the enormous demand for computer products. In fact, there is a greater need to import both from other CEMA countries and from the West. Even the USSR is a member of CEMA and has been particularly interested in modern Western technology of all kinds. In spite of the export restrictions, in the past it has been possible that for almost all big-name computer products in the West to install systems in important points of the Soviet economy. Not only were existing gaps filled but an attempt was made to reduce the time lag in the area of electronics between the USSR and the United States. Nevertheless, it would be wrong to assume that the current level of Soviet computer engineering has been attained exclusively by means of Western know-how and technology transfer.[10] No doubt Soviet research and refinements in electronics in recent years have provided a significant contribution, which has led in part to their successes in space.[11] But in a given case, one must assume that the Soviets are using their best technologies almost entirely in the military sphere and are neglecting the commercial sector. Thus imports from other CEMA countries or the West must meet the needs of companies and government agencies for computers.

3. The GDR Exhibits at the Fair

3.1 Key Technologies on the Advance

The GDR used the spring fair in Leipzig and to a lesser extent in Hannover as an opportunity to present its new microelectronics products. Key technologies took up the technical part of this fair. Given the fullness of the user-solutions and products from the GDR, the exhibits of the other CEMA countries were relatively modest, in spite of several interesting new presentations. This is no surprise, since naturally an attempt is always made of use the "home advantage" and to present to the international public as many new domestic developments as possible.

Even before the actual beginning of the fair in Leipzig, there was the "Third International Congress on Metal Processing 1982 (IKM 82)" from 10 to 12 March 1982 under the topic of "Rational Metal Processing With High-performance Tools and Modern Automation Equipment."[12] Sponsored by the Chamber of Technology (KDT) of the GDR, the Combines of Machine-tool Building, the Robotron Combine of Dresden, the Technical University of Dresden and the Technical University of Magdeburg and Karl-Marx-Stadt, this event formed the impulse of the exposition program of the spring fair. Following the current trend, the emphasis of IKM 82 was on microelectronics and electronic computer engineering and the potential for automation arising from these technologies.

At the next fair, exhibits from the Combines of Machine Tool Building of the GDR took up considerable space, while following the direction set by IKM 82. They were designed to demonstrate to the public the status of practical microelectronic applications in the GDR. Special milling and grinding tools, manipulators and industrial robots were presented. As was emphasized, the microprocessor-controlled processing centers can be expanded through the addition of tool stores to production cells. Freely programmable microprocessor controls, model "CNC 600" and special microelectronic control systems from the VEB [State Enterprise] Numerik "Karl Marx," Karl-Marx-Stadt, the general producers of robot controls in the GDR and the company of the Combine for Automation Systems Construction in East Berlin, form the technical core of these new products. From this company also come the manual input control "CNC-H-600," a freely programmable control for point-controlled industrial robots and manipulators, and the freely programmable process control "PC 600," which was shown for the first time at the fair.

As the director for sales and foreign trade of the VEB Numerik "Karl Marx" Karl-Marx-Stadt, Dipl.-Ing. Meschner reported that through the use of microelectronics, the level of control engineering in the GDR has been increased significantly. Thus, on the basis of existing potentials, the company seems able to become active in Western markets. The prognosis for sales is viewed to be quite positive, because close contacts "with a Western, industrial country" are said to have been established. This country is probably France.

The VEB Elektropoject and Systems Construction in East Berlin, the parent company of the Combine for Automation Systems Construction, presented the automation of industrial systems using the example of a rolling-mill process based on the universal microcomputer-controlled automation system "audatec" presented for the first time at the fair. This system, as stressed by the press agent to the general director of the Combine for Automation Systems Construction, is a functionally and spacially decentralized automation system which is created on two levels.

The use of microelectronics was also demonstrated by other industrial combines. Among the industrial robots presented at the fair was the "IRS 300" robot with coolable grasper systems for handling workpieces weighing up to 300 kg for foundry and forging operations from the State Heavy Tools Combine "Ernst Thalmann" (SKET) in Magdeburg. The combine also presented a new microcomputer-controlled telephone wire lane for the production of plastic-insulated telephone wires and circuit wires.

In the foreground of the exhibits of the VEB Carl Zeiss in Jena was the new equipment generation of microlithographic equipment. This is designed primarily for working with 150-mm-diameter silicon wafers and for the VLSI technique. As stated in a brochure, all equipment was developed under close cooperation with Soviet partners[13] and they should meet the requirements of production and control of templates for the structuring processes in the microelectronics industry of the GDR in the 1980s.

3.2 The Production and Exposition Emphasis of Robotron of Dresden: The "Decentral Data Equipment" Products

3.2.1 Robotron's Production and Delivery Program

The production and delivery program of the VEB Combine Robotron of Dresden presently comprises the following groups of products:[14]

--Electronic data processing systems (EC 1055 and EC 1005M) and peripheral equipment of the ESER;

--Products of the "Decentral Data Engineering" Program;

--Programmable minicomputers (Robotron K 1001, K 1002 and K 1003) and microcomputer systems (Robotron K 1510, K 1520 and K 1600);

--Electronic booking and invoicing machines (for example, Robotron 1355, Robotron 1711 and Robotron 1720);

--Products for writing (mechanical and electrical office writing machines, small-print machines, the "Erika Picht 500" sheet-fed offset press, the "Erika 70" document-writing machine and the "S 6001" electronic writing machine);

--Drawing machines and organizational equipment (for example, EDP-related accessories, recording, mapping and planning equipment and products of the Robotron REISS program, like drawing tables, etc.);

--Electronic measuring equipment (for example, equipment analysis and radiation measurement, equipment for measurement and test enhancement, fault-locating equipment for cables and lines, fire-warning equipment and equipment for sound vibration engineering);

--Radio relay equipment (narrow-band radio relay facilities and portable radio-relay stations);

--Consumer electronics (for example, TV receivers, stereo systems, radio sets)[15] and

--Command equipment, power-supply modules and magnetic heads.

Besides these systems and equipment, Robotron provides software packets specificially for users of its electronic computer systems.

Figure 1. The Robotron Product Spectrum for 1982

<table>
<tr><th colspan="8">Robotron - Produktions - Programm 1982 (1)</th></tr>
<tr><td colspan="2">Erzeugnisse der elektron. Rechentechnik (Hard- und Software) (2)</td><td rowspan="2">Schreibtechnik (3)</td><td rowspan="2">Zeichenanlagen und Organisationstechnik (4)</td><td rowspan="2">Elektronische Meßtechnik (5)</td><td rowspan="2">Richtfunktechnik (6)</td><td rowspan="2">Unterhaltungselektronik (7)</td><td rowspan="2">Befehlsgeräte, Stromversorgungsmodule usw. (8)</td></tr>
<tr><td>ESER-EDVA und -Peripherie (9)</td><td>Erzeugnisprogramm "Dezentrale Datentechnik" (10)</td></tr>
</table>

Schematic Illustration From the Production and Delivery Program of Robotron

Key:

1. Robotron production program 1982
2. Electronic computer products (hardware and software)
3. Writing equipment
4. Drawing systems and organization equipment
5. Electronic measuring equipment
6. Radio relay equipment
7. Consumer electronics
8. Command equipment, power supply modules, etc.
9. ESER-EDVA and periphery
10. "Decentral data equipment" products

3.2.2 The Emphasis of the Fair: "Decentral Data Engineering" Products

It can be assumed that both the products of the "Uniform System of Electronic Computing Technology" (ESER) as well as the new product program "Decentral Data Engineering," some of whose products were presented for the first time at the Leipzing Spring Fair in 1980, form the actual core of the Robotron production program. Thus the Robotron Combine of Dresden is the sole producer of computer products and the sole representative of the data processing and office machine industry of the GDR.

The primary characteristic of the new Robotron product program "Decentral Data Engineering" is the modular base concept of equipment and software,[16] which uses the Robotron microcomputer systems K 1520, K 1620 and K 1630.

The new product program includes primarily the following product groups:[17]

--Office computers in three different performance classes (A5110, A5120, A5130);

--Basic computer systems, including the commercial basic computer systems A 6401, successor to the Robotron 300 and Robotron 4201[18] computers, and 6402, the terminal-oriented basic computer systems A 6421 and A 6422 and the process computer systems A 6491 and A 6492;

--Data acquisition equipment (document reader and data collection system);

--One text system;

--Terminals and

--OEM products.[19]

Both at the Leipzing Spring Fair and at the Hannover Fair of 1982, products from the "Decentral Data Engineering" program have been emphasized in the Robotron exhibit. In Leipzig, user solutions selected with reference to the preceding IKM 82 took a prominent position. For example, special user solutions were presented for machine-building operations which were worked out jointly by Robotron and the machine-tool industry of the GDR. Robotron also exhibited a new software solution for a "complex material balance for industry and commerce" based on the A 6402 computer system with incorporated one-line coupled screen terminal and a newly developed "workplace for design engineers and technicians" (Designation: A 6450) based on the K 1620 microcomputer system, with which it is possible, according to the Robotron exhibit, to produce conductor plates.[20] This new product is included in the "Decentral Data Engineering" program.

As an example of the use of equipment design and software in medicine, Robotron presented the microcomputer-controlled cancer irradiation-planning system "DOPSY."[21] The main component of this system is the Robotron microcomputer K 1630 with special I/O-units.

Figure 2. Robotron Microcomputer Systems in the "Decentral Data Engineering" Program*

Microcomputer system	Modules	Technical Performance Parameters
K 1520	CPU K 2521	8 bit, N MOS-CPU U 880 D, 3K byte PROM, 1 K byte RAM
	CPU K 2525	Corresponds to the K2521, 8 K byte PROM
	CPU K 2526	Corresponds to the K2521, but two processors, 1 K byte RAM
	Memory modules	RAM, PROM, ROM, max. addressable capacity: 64K byte
K 1620	CPU K 2662, memory modules	16-bit parallel, two N MOS-CPU U 830 max. addressable capacity: 64 K byte (32K words)
K 1630	CPU K 2663, memory management unit K 2061	16-bit parallel, like K 2662
	Arithmetic processor K2062 memory modules	Like K 2663, special microprograms, maximum addressable capacity: 256 K bytes (128 K words)

Abbreviations:

Bit: Binary digit, binary character, smallest presentation unit for binary data
Byte: Unit for information to be processed jointly. It is composed of nine bits, of which eight are data bits and the ninth is a test-bit
CPU: Central processing unit
MOS: Metal oxide semiconductor (transistor), which permits very high switching input resistances
N MOS: N-channel-MOS, MOS-technology which permits medium-high switching speeds
PROM: Programmable Read-only Memory
RAM: Random Access Memory, direct access memory
ROM: Read-only Memory, fixed-value memory

*Source: Werner Schulze, "Grundkonzeption des Erzeugnisprogramms 'Dezentrale Datentechnik,'" op. cit., p 7.

Figure 3. Equipment From the "Decentral Data Engineering" Program and Applied Examples

Gerätebezeichnungen (1)		Robotron- und SKR-Chiffre (2)	Mikrorechner/ Mikrorechnermodule (3)	(4) Ausstattung und Anwendungsbeispiele
(7) Bürocomputer		A 5110	K 2526 (K 1520)	Ausstattung: Tastatur, Drucker, Speichereinheiten, (5) Buchungs- u. Abrechnungsaufgaben, DFÜ-Anschluß usw.
		A 5120		Ausstattung ähnlich wie A 5110; dialogorientierte Datenerfassung, Stapeldatenübertragung, Maximaltextverarbeitung (6)
		A 5130		Ausstattung ähnlich wie A 5110; Buchung, Fakturierung, Abrechnung, dialogorientierte Datenerfassung, Nebentextverarbeitung (8)
Basis- (12) rechner- systeme	(10) Kommerzielle Basisrechner- systeme	A 6401	K 1620	Ausstattung: Lochbandeinheit, externe Speicher, Bildschirmdrucker, Multiplexor usw.; (9) wissenschaftlich-technische sowie kommerzielle DV im Solobetrieb oder als Satellitenrechner
		A 6402	K 1630	wie A 6401, jedoch mit höherer Leistungsfähigkeit (11)
	Terminal orientierte (13) Basisrechner- systeme	A 6421 A 6422	K 1620 K 1630	wie A 6401 und A 6402 mit Datenkommunikation über Terminals (14)
	Prozeßrechner- systeme (16)	A 6491 A 6492	K 1620 K 1630	automatische Prozeßsteuerung, Labor- und Prüffeldautomatisierung (15)
(17) Datener- fassungs- geräte	Belegleser (18)	A 5210	K 2521 (K 1520)	Ausstattung: Kassettenmagnetband, Folienspeicher; (19) automatische Erfassung alphanumerischer Informationen
	Datensammel- system (21)	A 5220	K 2526 (K 1520)	Ausstattung: Datenstationen, Magnetbandgerät, DFÜ-Anschluß, Seriendrucker, Bildschirm; (20) Mehrplatzsystem zur Massendatenerfassung auf Magnetdatenträgern
Textsystem (22)		A 5310	K 2526 (K 1520)	Ausstattung: Folienspeicher, Seriendrucker, Bildschirm, DFÜ-Anschluß, Tastaturen; (23) Textbearbeitung, Datenverwaltung
Terminals (35) und OEM-Erzeugnisse	Mikrorechner- entwicklungs- system (24)	A 5601	K 2521 (K 1520)	Ausstattung: Folienspeicher, Lochbandeinheit, Tastatur, Seriendrucker, Bildschirm; (25) Programmentwicklung für das Mikrorechnersystem K 1520
	Mikrorechner- systeme (26)	K 1520 CM 50/40-2 K 1620 K 1630		Baugruppen für OEM-Einsatz, Grundlage für Erzeugnisse auf Mikrorechnerbasis wie z.B. Robotersteuerungen usw. (27)
	Konzentrator (28) Multiplexor	K 8521 K 8523	K 2521 (K 1520)	Datenübertragung, Nachrichtensteuerung, Netzsteuerung (29)
	Konzentrator (28) Multiplexor	K 8561 K 8563	K 1630	programmierte Übertragungs- u. Leitungssteuerung, Nachrichten- u. Netzsteuerung (30)
	Bildschirm- (31) Ein- u. Aus- gabegerät	K 8911	K 2521 (K 1520)	Ausstattung: Bildschirm, Tastatur, DFÜ-Anschluß; Bedieneinheit, Dialogterminal für Nahverkehr (32)
	Bildschirm- terminal (33)	K 8912	K 2521 (K 1520)	Ausstattung wie K 8911; Dialogterminal für Fernverkehr (34)
	Datenstation (36)	K 8913	K 2521 (K 1520)	Ausstattung wie K 8911; Einsatz in Datensammelsystemen (37)
	Platzreser- vierungstermi- nals (38)	K 8927	K 2526 (K 1520)	Ausstattung: Tastatur, Bildschirm, Seriendrucker, Folienspeicher, DFÜ-Anschluß; (39) Bedienplatz für Reservierungsaufgaben in Fernverarbeitungssystemen, einschlägige Dialogverarbeitung
	Universelles Bildschirm- terminal (41) (UBT)	K 8931 CM 1616	K 2526 (K 1520)	(40) Ausstattung wie A 5120; Dialog- u. Stapelverarbeitung in Feinverarbeitungssystemen
	Drucker- (42) terminal	K 8951	K 2526 (K 1520)	Ausstattung: Tastatur, Seriendrucker, Bildschirm, DFÜ-Anschluß; (43) dezentrales Auslistgerät u. blattorientiertes Eingabegerät

-Compiled from: Schulze: "Basic Conception of the 'Decentral Data Engineering' Product Line," op. cit., pp 8 and 9; Information compilation "Robotron '82" of the State Robotron Combine and special product information of the State Robotron Combine, Dresden, for the Leipzig and Hannover Fairs, 1982.

[Key on following page]

[Key to Figure 3]

Key:

1. Equipment designations
2. Robotron and SKL cipher
3. Microcomputer/microcomputer modules
4. Equipment and examples of use
5. Equipment: keyboard, printer, memory units, invoicing and accounting tasks, DFU-junction, etc.
6. Equipment: similar to A5110; dialogue-oriented data acquisition, stack data transfer, maximum text processing
7. Office computer
8. Equipment: similar to A5110; invoicing, accounting, settlement statements, dialogue-oriented data acquisition, side-text processing
9. Equipment: Punched-tape reader, external memory, screen printer, MP, etc.; scientific, technical and commercial data processing in solo-operation or satellite computer
10. Commercial-base computer systems
11. Like A6401 but with greater capabilities
12. Base computer systems
13. Terminal-oriented base computer systems
14. Like A6401 and A6402 with data communication via terminals
15. Automatic process control, laboratory and test-field automation
16. Process computer systems
17. Data acquisition equipment
18. Document reader
19. Equipment: cassette tape, foil memory, automatic acquisition of alpha-numeric information
20. Equipment: data terminals, magnetic tape recorder, DFU-junction, series printer, screen; multisite system for mass data acquisition on magnetic storage systems
21. Data collection system
22. Text system
23. Equipment: foil memory, series printer, screen, DFU-junction, keyboards; text processing, data management
24. Microcomputer development system
25. Equipment: foil memory, punched-tape unit, keyboard, series printer, screen; program development for the K1520 microcomputer system
26. Microcomputer systems
27. Assemblies for OEM-use, foundation for products based on microcomputer as, for example, Robot controls, etc.
28. Concentrator
29. Data transfer, information control, mains control
30. Programmed transfer and line control, information and mains control
31. Screen input/output equipment
32. Equipment: screen, keyboard, DFU-junction; control unit, dialogue terminal for short-range communication
33. Videoscreen terminal
34. Equipment like K 8911; use in data collection systems
35. Terminals and OEM products
36. Data station
37. Equipment like K 8911; use in data collection systems
38. Space reservations terminals

[Key continued on following page]

[Key to Table 3 continued]

39. Equipment: keyboard, screen, series printer, foil memory, DFU-junction; operator's console for reservation tasks in teleprocessing systems, pertinent dialogue processing
40. Equipment: like A5120; dialogue and stack processing in fine-processing systems
41. Universal video terminal (UBT)
42. Printer terminal
43. Equipment: keyboard, series printer, screen, DFU-junction; decentral listing equipment and page-oriented input unit

The hardware-configuration of the K 1630 consists of the CPU with arithmetic processor (with a processing width of 16 bits parallel with an addressing range of 256 bytes). As a data carrier, a cassette disc memory with 25 M/disk and two floppy-disk drives with 3.2 M bit/drive are used.[22] The periphery is adapted to the special applications. The following elements belong to the system:

--A universal video terminal for the data I/O and dialogue exchange,
--A digitalizing table for input of patient profiles and of geometric data,
--A graphic screen for output of patient profiles and of irradiation parameters and dose distribution,
--A four-color plotter and
--Finally, the MOOS (modular operation system).[23]

As we found at the Robotron exhibit in Leipzig, the cancer irradiation planning system offers the potential for individual irradiation planning for each patient.

Based on equipment from the "Decentral Data Engineering" product line, the new "Reservation and Information System for Hotels, AURIS 1600" was presented. The applied solution is offered in three basic versions:[24]

--In the form of a room reservation terminal, Robotron K 8927 as solo unit in a hotel reception,
--As a basic computer system, Robotron A 6401, with several terminals,
--As a basic computer system, Robotron A 6402, likewise with several terminals, for example, for travel agencies.

As one could also learn at the Robotron exhibit in Leipzig, a number of programs are available for workplace-oriented use of the Robotron office computers and basic computers for rationalizing work in material and warehouse management, production preparations, task manipulation and text processing.

Besides the hardware products from the "Decentral Data Engineering" line, Robotron also exhibited the "EC 2655M" CPU, which has been known for over 1 year together with a newly-developed service processor and ESER-periphery from other CEMA countries. One particular characteristic of the new Robotron hardware of the ESER was the reduction of the equipment volume by 33 percent while simultaneously increasing the main memory capacity to 200 percent through the incorporation of highly integrated circuiting. At the fair in Leipzig, the "Decentral Data Engineering" product line was first demonstrated with the Robotron ESER system EC 1055 M.[25]

Among the new developments of Robotron is also the "SK 4310 ENSAD" control computer for use in communications.[26] This computer forms the basis for the control of telephone centrals of up to 4000 junctions. The processor handles around 300,000 operations per second. According to Robotron there are 46 partly specialized commands and 18 control commands available for handling exchange problems. A special interruption and priority control should permit the handling of calls on eight program levels. The width of processing of the eight registers was cited as 16 bit.

Finally, among the Robotron Fair Exhibits is also the System for Automatic Ski Jump Width Measurement Record 30 which has just been used at the World Jumping Championships in Norway. The Robotron microcomputer K 1520 is the core of this system.

Of the OEM assemblies there are refined, contactless keyboards and a series of power supply aggregates and thermostrip printers TSD 16 with printer and single-sheet insertion in the Robotron product line.

In Hannover as well, the products from the "Decentral Data Engineering" line dominated.[27] The center of the Robotron exhibit was the basic commercial computer system Robotron A 6402, whose foundation is the Robotron microcomputer K1630. In addition, Robotron presented the office computer systems A 5110 and A 5120, basis of which was the Robotron microcomputer system K 1520 with 8-bit CPU U 880 D, the data acquisition system A 5220 and various OEM products.

Robotron also demonstrated special applied solutions in Hannover while using the hardware named above. Counted among this was the Robotron Irradiation Planning DOPSY[28] presented previously at the Leipzig Spring Fair 1982. In addition, Robotron presented the organization and software packet MARMEDO[29] and the birth monitoring device NATALI.[30] The offered software packet for the MARMEDO system contains potentials for X-ray or EKG findings and a computer-controlled scheduling control. The NATALI system, however, is designed for microcomputer-controlled monitoring of the birth process. In both cases, the office computer system A 5120 with application-specific configuration forms the hardware basis.

It must be assumed that not all products of the "Decentral Data Engineering" line are in mass production and that surely changes to existing product designs and supplementation of the product assortment will yet be undertaken. Thus the range of products shown in Figure 3 can be viewed only as a planning framework within which some production goals have been reached. Nonetheless, with a program capable of producing a number of fine-tuned products, a real possibility has been found for reducing the existing gap with the West in the area of electronic computing technology.

3.3 The Line Information System as a Computer Solution

The Robotron Combine of Dresden offers hardware and a series of "user-oriented solutions and system solutions."[31] Some of these solutions and services were the subject of technical presentations sponsored by Robotron within the framework of the Scientific-Technical Convention Program at the Leipzig Spring Fair 1982.[32]

Of particular interest was the Robotron-developed management information system, Leit information system/Robotron, LIS/R, also called the Management Information System by the editor, which was presented as an instrument for computer-aided decisionmaking for the management of economic units.[33] The utilization of this information system is supported, according to Robotron, by programming and methodological components and universal problem-oriented software. The essential element of the entire system is a central data bank. The equipment basis is a universal computer or ESER systems like the Robotron EDVA EC 1055 or EC 1055 M "with at least 1024-K-byte main memory capacity and a number of modern peripheral units coordinated to the real application."[34] As additional hardware, the use of products from the "Decentral Data Engineering" line should also be possible.

One cannot tell from the pertinent GDR literature what position this design of a computer-aided information system will take next to the long-known "Automated Management Systems for Factories"[35] or the other forms of "computer-aided information systems (RIS)."[36]

3.4 Robotron Exports Within CEMA

During the Leipzig fair it was acknowledged that on the basis of existing contracts, Robotron was to deliver data processing systems, invoicing and accounting machines and printing machines to the Soviet Union.[37] The total value of mutual deliveries is about 228 million rubles, according to information in NEUES DUETSCHLAND. Delivery agreements have also been concluded with other CEMA countires. Czechoslovakia has ordered EDP systems, accounting, invoicing and data acquisition equipment valued at around 27 million rubles.[38] Export to Hungary of data acquisition and printing equipment and accounting and invoicing machines valued at about 15 million rubles is intended, and Poland has purchased Robotron products valued at 14 million rubles.[39] Even the Bulgarian foreign trade company Isotimpex has purchased an EC 1055 ESER-EDVA from Robotron.

4. Hungary's High Performance Hardware and Software

In addition to its active participation in the Uniform System of Electronic Computing Technology (ESER) of the CEMA countries[40] and in future in the "System of Minicomputers (SKR),"[41] the development of electronic computing technology in Hungary was also determined by cooperation with Western firms. Numerous licensing and delivery contracts with Western EDP manufacturers contributed to the rapid advance of Hungarian computer products. The basis for the success of Hungarian computing technology was not only a capable EDP industry but also a relatively capable electronics industry.

4.1 The New Development Program of the Electronic Industry as a Pathfinder for the 1980s

A sustained increase in production of computer products has been underway in Hungary due to the development program for the electronics industry decreed at the end of 1981. A total of 2.4 billion forints is earmarked for investment by 1985 for implementation of this program for the expansion of production of

integrated circuits (IC).[42] The pertinent planning foresees, in the words of the responsible government commissar, Mihaly Sandory, the production of ICs by a newly founded production company instead of by the existing electronics companies.[43]

4.2 Currently Active Producers in the Area of Electronic Computer Technology and Their Most Important Products

A number of production concerns are active in Hungary in the area of electronic computers. Among them are:[44]

(1) Videoton Szamitastechnikai Gyara, Budapest, (Videoton Electronics Works, Budapest)

The Videoton Works in Szakesfehervar (about 70 km Southwest of Budapest) is an electronics combine (Videoton Combine) with about 18,000 employees. It is the largest producer of products for computing machines and consumer electronics and is organized into four departments:[45]

--the computer works,
--the television radio factory,
--the information works, and
--a division for production preparation.

The largest Hungarian manufacturer of computer products makes the:

--EC 1010 computer system (EDP system of ESER series 1) with its refinements, the EC 1011, EC 1012 and EC 1015 (EDP system of ESER series 2),
--computer system VT-20,
--microprocessor-controlled data base computer (office computer system) VT-30,
--computer systems VT-60 and VT-600,
--alpha-numeric video terminal series VIDEOTON VDT 52 100,
--parallel printer family Videoton 23 000,
--parallel printer family Videoton 27 000,
--terminal family VTS-56 100 and
--data acquisition system Videoplex-3.

The VIDEOTON Industry Foreign Trade Corporation in Budapest is responsible for the export of these products.

(2) Budapesti Radiotechnikai Gyar, BRG (Budapest Radiotechnical Works)

Among its products are the:

--Multichannel communication magnetic-tape unit, series SHR,
--magnetic tape converter,
--cassette tape unit and
--microcassette memory, type MCD-1.

The products of this firm are sold mostly by METRIMPEX, Budapest, the Hungarian foreign trade company handling instrumentation products. In the case of larger equipment, however, the VIDEOTON Industry Foreign Trade Corporation is responsible for export.

(3) Elektronikus Merokeszulekek Gyara, EMG (Plant for Electronic Measuring Instruments, Orion, Budapest)

This plant produces the following computer products:

--programmable electronic table-top computer, model 71-666, and
--thermoregister units, model 14,894.

The export of the EMG products is being taken over by METRIMPEX.

(4) Magyar Optikai Murek, MOM (Hungarian Optical Works, Budapest), which produces diskette drives, model MOMFLEX-3200.

MOM-products are usually exported by VIDEOTON Industry Foreign Trade Corporation.

(5) MMG Automatika Muvek, Budapest (Mechanical Measuring Instruments Plant)

Among the most important products of this firm are, for example, the microcomputers SAM-80, which with Intel CPU 8080A were presented at the Leipzig Spring Fair, 1979.

The foreign trade firm METRIMPEX is responsible for the export of products from this company.

(6) Scientific institutes have recently become known because of their high-performance electronic computer products. These are the:

--Hungarian Academy of Sciences, Central Institute for Physics, with the mini-computer system tpa-1 and the 16-bit computer tpa 1140, and
--Institute for Measuring and Computing Technology, Budapest, MTA KFKI, attached to the Central Institute, with the small computer EMU 11 (with Intel 3000 series microprocessor elements).

(7) Coordination Institute for Computer Engineering, Szki, Budapest

This institute was founded in 1968 and is one of the most important Hungarian research and development institutes active in the area of electronic computing engineering.[46] In addition, it is also active in the production of EDP systems and software development.[47]

(8) CSO, International Computer Education and Information Centre, Budapest (Central Agency for Statistics, International Education and Information Center for Data Processing, SZAMOK).

This institution has existed for several years and is active primarily in the area of EDP training and is also responsible for software development.[48]

4.3 The Fair Exhibits

Basically only known equipment and systems were presented at the fairs. In Leipzig these were the:[49]

--Small computer EC 1011 from the ESER production program manufactured by VIDEOTON. The configuration contained the VSD 47700 terminal by VIDEOTON, magnetic tape units, model EC 5017.02 by the State Combine, Carl Zeiss, Jena, GDR, the Videoton 27000 printer, 50-M-byte disk units by Videoton and a floppy disk unit of MOM.

--Communication terminal based on VT 53000. Its editor and transfer types permit, according to Videoton, the creation of random text files, program development, data conversation between floppy, punched tape and punched card and remote job entry function (job management) via synch line. For its use within the ESER, the model EC 8036 is provided.

--Video terminals from the Videoton VDT 52100 series. The modular design of this series should provide a flexible arrangement of system components suitable for various tasks, from the simplest teleprinter-compatible design to more demanding equipment serving terminal functions down to intelligent terminals.

--Data acquisition system ORDAS developed jointly with other CEMA countries. It has eight workplaces and can be used as an intelligent terminal in computer nets.

The emphasis of the exhibit in Hannover was on:[50]

--the VT 600 computer system with CAD/CAM-application examples (computer-aided design, computer-aided manufacturing),

--the dialog system VT 30 with the "Bora" software packet (screen-oriented travel agency application system) and

--the display terminal VDT 52121 (Videoton Terminal series VDT 52000) with Raster graphics.

Both in Leipzig and also in Hannover, the application programs and special software were presented together with the pertinent hardware.

4.4 New Sales Partner in the FRG

The sole sales representative for hardware and software of the Videoton Electronics Works in the FRG since July 1980 has been the VDT Computer Trade Company in Dusseldorf,[51]. At the International Tourism Bourse (ITB) in Berlin (2/27-3/5/82), this sales company presented a special applications program for travel agencies. The goal of Videoton is to gain access to the Western market through a combination of hardware and software in applications-oriented systems.

4.5 Reinforcing the Close Cooperation Between Videoton and Robotron

During his trip to Hungary Honecker also visited the Videoton plant. The "close relationships between Videoton and its partners in the GDR" were stressed as "visible example for the deepening bilateral cooperation" between both countries and for "the socialist economic integration."[52] As we also learn in this regard, there is close cooperation between Robotron and Videoton in particular. This is due primarily to the cooperative agreement concluded 2 years ago on the "Development and Mutual Delivery of Products for Remote Data Processing, Data Bank Processors, Microcomputer Modules and Line Printers."[53]

In the course of time, the GDR in addition to the USSR and CSSR has developed into one of the most important trade partners in CEMA for Videoton.[54]

5. The Electronic Computer Equipment of the USSR

5.1 USSR Relatively Reticent at Fairs

If we compare the exposition program of the USSR in recent years with that of other CEMA countries, we find that the potential for a performance demonstration at the fairs has not been used. Not only the relatively reticent presence in Leipzig and Hannover but also a continuing lack of product information at the fairs contribute to an incomplete picture of the Soviet EDP industry and its production program.[55] The USSR was represented in Leipzig with various exhibits but was absent this year from Hannover for unknown reasons, after having greatly reduced its presence there considerably last year. That the USSR has voluntarily withdrawn is even more surprising because Hannover with the CeBIT is a ranking fair and because, in spite of considerable expansion, a number of interested parties had to be excluded.

This unexplanable conduct of the Soviet Union has been a subject of much speculation about whether this behavior is intentional and what may be meant by their reticence. We shall not endeavor to interpret their actions.

5.2 Integrated Circuits: The Basis for Production of Microcomputers

According to statements of the Soviet electronics specialist Fedotov, the first integrated circuits were produced on Geranium and Silicon base "in the years 1961-1962."[56] Integrated circuits with different functions have been produced in series since about the mid 1970s. Among these are ROMs, RAMs and microprocessors.[57]

The production of microprocessors and microcomputers reported in the GDR journal RECHENTECHNIK/DATENVERARBEITUNG for the USSR in 1980 was for "hundreds of thousands of microprocessors in 10 different types, thousands of microcomputers and a million microcalculators in 30 designs."[58] In addition, in the same article it was pointed out that there is an "incorrect ratio between the rapidly growing production of microprocessors and their use. Many branches are not yet able

Figure 4. Soviet Microprocessor Types

Designation	Processing Width	Comparison Type
K 582 UИ 1	4 bit - CPU	Texas Instruments SPB 400 A
K 584 UИ 1	4 bit - CPU	
K 352 UИ 4	8 bit - CPU	Intel 8008
K 582 UИ 2	8 bit - CPU	Texas Instruments SPB 400
K 580 UИ 80	8 bit - CPU, CMOS	Texas Instruments TMS 8080
K 587 UИ 1	8 bit - CPU, CMOS	
K 588	8 bit - CPU, CMOS	

to use these microprocessors for the control of machines, systems and processes."[59] This is surely because the needed prerequisites in the production sphere are lacking. Furthermore, various ministries are responsible for the production of microprocessors and the resulting confused management has not proven useful for promoting the development of microelectronics. In order to alleviate such inequities, the following measures are planned:

--systematic educational courses for design engineers,
--processing of information via microprocessors and microcomputers and their functions and potential uses in a generally understood type and manner,
--specification of the organizations[60] responsible for methodical coordination "of the completion of programs for control systems, standardization of program packets and standardization" and
--organization of application centers.

Among the previous USSR-produced microcomputers are the ELEKTRONIKA 60 (Leipzig Spring Fair 1982) and ELEKTRONIKA NZ 03D (Leipzig Spring Fair 1980).

5.3 Research Institutes and Producers of Computer Products

Among the presently most important scientific research institutes and producers of computer equipment are the:

--Central Scientific Institute "Elektronika" in Moscow (manufacturer of microcomputers),

--Institute for Mathematic Machines in Yerevan (manufacturer of small computers of the NAIRI type),

--Institute for Control Systems of the Academy of Sciences of the Georgian SSR,

--Institute for Complex Automation (ZNIIKA) in Moscow,

--Science Research Institute for Process Computers in Severodonetsk,

--All-Union Science Research Institute for Electromechanics in Moscow,

--Union Research Institute for Cybernetics in Omsk,

--Research Organization of the Ministry for Equipment Construction, Automation Equipment and Management Systems for the creation of ASUP (ZNIITU) in Moscow,

--Central Research Institute for Experimental Projections in Construction at the GOSTROI (State Committee for Building Construction at the Ministerial Council of the USSR,

--Institute for Cybernetics at the Academy of Sciences of the Ukraine in Kiev, and

--the Minsk Production Union for Electronic Computer Engineering (manufacturer of ESER products, like the computers EC 1050 and EC 1060, including periphery).

The foreign trade company Electronorgtechnica in Moscow is responsible for sales of all products of electronic computer equipment.[61]

5.4 Fair Exhibits and Production Program

Among the products presented by Electronorgtechnica at the Leipzig Spring Fair in 1982 were:[62]

--The microcomputer Elektronika-60 M equipped with CMOS circuits.
--The control computer complex SM-4 within a collective exposition of the USSR and GDR.
--The graphic display CM 7300, intended for interactive communication between user and computer.
--The measuring system HEVAS as a joint development of institutions from five CEMA countries. It was linked via a CAMAC interface[63] with the Soviet small computer system CM4 (system for small computers, SKR) and can be used, according to reports at the fair, in medicine and materials testing.
--Finally, ESER control units for magnetic tape memory, magnetic disk memories and electronic accounting machines ISKRA 555 with display and series printer were seen.

These fair exhibits represent only a small part of the current range of products of the Soviet computer industry. Among its products are:

--Systems and peripheral equipment of the ESER,[64] to wit:

the computer systems EC 1022, EC 1033, EC 1035 and EC 1060,

moving head disk, memory control units, magnetic tape memories, tape control units, punched tape readers and punchers, punched card readers, printers, video terminals, terminals and modems.

--Systems and peripheral equipment of the small computer systems:[65]

the small or process computer systems CM-1, CM-2, CM-3, CM-4[66] and peripheral equipment, for example, disk memory control units, magnetic tape memories and displays.

--Systems and equipment not belonging to ESER or SKR, for example:

microcomputers (model "Elektronika"), small computers ISKRA554 and ISKRA555, terminal processors of the BARS series and displays designated DM-2000 and ITEKAN-E.

Besides the systems and equipment mentioned above, the following main systems are in use:[67]

--the small computer systems NAIRI 4 from the Institute for Mathematic Machines in Yerevan (500,000 operations/s);
--computers from the "Multiprocessor systems family" designated "ELBRUS" (including the EDP system ELBRUS-1 and ELBRUS-2);[68]
--control computers designated M-5000, M-6000, M-7000 (with 128 K operative memory), M 4030, M 4030-1 and M-400 (these systems are computers of the "Assembly of Prefabricated Machine Parts" type which are designed for the automatic control of production sequences and for the implementation of certain research and development work), and
--analog computer systems like the ABK-2 computer.
--In addition, based on the existing short supply of computers, besides the "outdated" systems of the second generation, the first computers of the third generation like MINSK 32, BESM 6, M 222 and DNIEPR II are surely also in use.
--The scope of systems coming from Soviet production is supplemented by systems from other CEMA countries like the GDR (for example, ESER computers EC 1040 and EC 1055 and office computers) and Poland, and, not least,
--through imported Western computers (for example, IBM, CDC, ICL, SIEMENS, etc.).

At no time have there been accurate figures available on the current numbers of computers. According to unconfirmed reports, at the end of 1969 and beginning of 1970 there were 6,000 computers in operation in the Soviet Union.[69] According to other reports at that time there were only 4,200 systems in use.[70] By 1977 the stock of computers had risen to about 16,000 EDP systems (including small and process computers), likewise according to unconfirmed reports.[71] Due to existing development and assuming the accuracy of the numbers established for 1977, one can assume that at present there are around 40,000 computer systems in the Soviet Union (including microcomputers, small and process computers and Universal computers).

5.5 Characteristics of EDP Development: EDP Production Insufficient for Meeting Domestic Needs

Compared to the United States, the Soviet Union began the production of electronic computing systems relatively late. The Soviet scientist Dorodnitsyn stated in this regard, "It was the underestimation of the applications of electronic

computing machines in the economy which led to the discrepency between its electronic brain and the external facilities. The production of electronic computing machines began with us after a time loss of about 5 years compared to the United States; this delay was due to the losses and difficulties we experienced during and immediately after the war."[72]

According to Soviet sources, the Institute for Electronics of the Academy of Sciences of the Ukraine built the first computer system in 1951.[73] This system (designated MESM, Malaya Electronnaia Scetnaia Masina[74]) was a synchronous-operating three-address computer with a working speed of 50 arithmetic and logic commands per second. As was said about this computer, "many scientific-technical and economic problems were solved"[75] with its aid. After the MESM computer came the development of the BESM (Bystrodeistvuiuscaia Elektronnaia Scetnaia Masina[76]) computer systems. "The first BESM was put into operation in 1953 and...used to solve important scientific-technical problems."[77] In other publications on Soviet EDP development, we read, however, that the first Soviet computer (Strela) was put into operation in 1953 after development at the Institute for Mechanics and Instrument Design of the Ministry for Radio-industry.[78] Nonetheless, the reason for the lag in the development and production of electronic computing systems compared to the United States, in spite of the assertion of Dorodizyn, is more likely that only after the death of Stalin was there a change in the estimation of "capitalistic" instrumentation and methods of organization and the knowledge of cybernetics. Thus the potentials of EDP were realized rather late. The lag behind the United States in development, production and use of EDP began at an early date. This situation of the beginning Soviet computer industry was impeded primarily due to defective and uncoordinated development concepts and an insufficient mastery of the transfer of scientific know-how to production.[79] Characteristic of EDP development in the 1950s and 1960s are the following:

--Soviet computers are mostly institutional developments;
--computers were usually produced singly in the various institutes;
--instead of low-cost mass production, as a rule small-series production was favored (only 3 to 20 samples of a computer type were built; of the computer Kiev, built in 1967, there was only one sample);
--computer development and production by the individual institutions was little coordinated until about the beginning of the 1970s in spite of (or because of?) central planning;
--systems built up to 1970 were incompatible with each other, and even within a model series the computers had different characteristics;
--the transition from the second to the third computer generation did not began until 1969 with the NAIRI-3 computer. After 1972 the final transition to the third generation began in the USSR and the other CEMA countries with the ESER systems.[80]

The first electronic computing systems were used in the USSR initially for performing scientific-technical work and then increasingly for production. Later, their value in the design of planning processes was recognized and they were used for "perfection of plans."[81] During the 1960s the development of a "state network of computer centers" began; with its aid a "uniform automatic system of optimum management and planning for the country" was to be created.[82] This computer net was to be "built up independently of the principle of distributed management" and was to be used for handling three problem areas. These were:

--problems of state economic planning,
--problems of operative management and computation (operative management of production problems and operations, financial calculations, computing and statistics) and
--other problems (special problems).[83]

The use of electronic computing systems in as many areas of the state economy as possible was a primary motivation for the Scientific Conference on the Application of Electronic Computing Technology, established in the 1960.[84] Among the central themes of the Third Scientific Conference on Questions of Applied Electronic Computing Machines for Production Management, held from 2-3 December at the Moscow economic institute Ordzhonikidze, were:[85]

(1) "application of electronic computing machines for production management,"
(2) "primary tasks and directions for automated systems of production management,"
(3) "application of electronic computing machines in a system of continuous, operative production planning" and
(4) material calculations using electronic computing machines, etc.

As one can find in the USSR publications of this period, computer technology with state support began to be used more and more as a welcome aid in solving planning and management problems. Nonetheless, the development of computer technology remained a source of concern for the state and party leadership; calls for fast development of computer technology and its use were just about useless. Development programs remained piecemeal and thus only a few state planning organs, research and development facilities and, not the least, the entire military sphere could draw some benefit from the existing computer potentials. But for innumerable jobs in the factories and in the central state management there was hardly any copiers and electronic typewriters were virtually unknown, not to mention electronic data processing systems. The computer network thus determined the average level of technical equipment in most administrations until now. Thus, at the Systemotechnika '71 in Leningrad, Soviet representatives publicly admitted that there was an enormous catch-up demand in the Soviet Union in the area of office automation which was to be made up not from domestic developments but from imports from the West.[86]

Doubtless the electric and electronic computing machines and modern organization equipment are being used, but their density of employment is still comparatively low. Exceptions will confirm the rule here: high officials have achieved a high level of technical proficiency in their offices because they use high-performance systems and equipment and Western products decisively affect technical performance.

In spite of numerous and sometimes very critical statements on the new situation since the 1970s and in spite of state development programs, the Soviet computer industry has never been able to meet the demand for computers. To produce enough quality as well, there are numerous problems with domestic computers, as one can ascertain from situation reports in the Soviet daily press from the 1960s and 1970s.[87] Accordingly, the Soviets were quite eager to import high-performance and reliable systems and equipment from Western countries in order to place them at important centers of science and business. For example,

they have imported English Argus process-computer systems for the Nishnekamsk truck factory, electronic equipment for a Leningrad Olivetti factory, Swedish computers for the Moscow airport, ICL computers for the Academy of Medical Sciences in Moscow, etc.[88] No doubt the Soviet EDP industry has been able to surmount various typical deficiencies from the 1950s and 1960 through concentration of production and increased performance capabilities. Nevertheless, development trends in the 1980s show that production deficiencies still exist. We read, for example, in a business brochure of the Dusseldorf Trade Fair mbH, NOVEA, on the occasion of SYSTEMOTECHNIKA 1980 in Leningrade that "Soviet planning foresees the increasing use of organizational means and data processing technology. The demand from a quantitative and qualitative standpoint can be met only to a limited extent from Soviet production." The center of this demand are the areas of industry and administration and "institutions for scientific-technical information."[89] In the meantime, the more strictly enforced American embargo on the export of electronic systems and equipment to CEMA countries is a hindrance, but the existing export restrictions continue to be circumvented by resourceful Western businesspeople. The most recent example is the delivery of high-performance PDP-11 computers from the Digital Equipment Corporation (DEC) in the United States which was destined for the Soviet Union and was approved by German customs due to a lack of personnel at the American customs administration at the Frankfurt airport. Various reports in this case stated that the computers were to move via Canada, the FRG and Switzerland into the Soviet Union.[90]

5.6 The Development of Automated Management Systems in the USSR

5.6.1 Historical Development

In the 1960s in the Soviet Union the idea arose for the development of computer-supported management systems. For instance, Pugatshov stated in a paper on the development of computer engineering: "The application of mathematics and computer technology to economics has moved into a new development phase. A great task stands before the Soviet economists to create a uniform, automatic system of optimum management and planning for the country. Its technical basis must be the uniform state network of computer centers..."[91] With the aid of such a management system for the entire economy, it was intended to create an optimum national economic plan and a computer-based control of plan implementation. In addition, the intended implementation of "automated systems of production management" of factories was a subsystem of the above economic management system. In this case we are dealing with EDP-based systems for collecting and manipulating data in the production sequence, including its side processes, and the preparation of information for central economic management organs. Emphasis of this kind of information acquisition was naturally on the data for fulfilling the plan (desired-actual comparisons).

The development of such management systems and the problems connected with it were the subject of the Third Scientific Conference on Questions of the Application of Electronic Computing Machines to Production Management.[92] Based on initial knowledge gained in this beginning phase after 1963[93] and on state-directed development goals, the remaining work on implementation of computer-based management systems was completed. After the middle of the 1960s, an increasing

dispute on problems of EDP use in the economy and especially on questions of implementation of automated management systems[94] appeared both in the daily as well as the technical press. At first, there were reports on initial experiences in the creation of an "industry-related information system"[95] and then more and more on specific "automated management systems" in factories.[96] Among the best known management systems developed in the initial phase between 1963 and 1971 are the: (1) "automated system of production management" developed in the Moscow plant for the production of "Freser" tools in stages, also called the Freser system.[97] The Freser system is composed of the following six subsystems:

--the system for operative control of production,
--the system for technical-economic planning,
--the system of material-technical supply,
--the system for technical preparation for production,
--the system for sales of finished products and
--the system for accounting.

The computer basis of this system is made up of three electronic computing machines, that is, one Soviet Ural 11 and two Polish Odra 1003 model systems.

(2) The "automated system of production management" in the LVOV television plant;[98]

(3) the "automated management system for machine building, ASUPRIBOR";[99]

(4) the system Stshokino of the Chemicals Combine to optimize information flow[100] and

(5) the "automated management system Cement-1" of the Soviet construction industry which has been created through the cooperative efforts of several factories and institutes.[101]

The development of automated management systems was finally stressed at the 24th Congress of the Communist Party of the Soviet Union as the "primary form of EDP application."[102] The directives of the party congress on the 5-year plan of 1971-1975 specified:

"All efforts must be made to create and start up automated systems for the planning and management of industrial branches, territorial organizations, unions and factories under the aspect of working out the overall state system for information storage and processing for accounting management, planning and management of the state economy based on a state network of computer centers and on a uniform, automated data transmission network in the country."[103]

In the meantime, due to the advancement of the overall complex of the automated management systems, an initial definition of the concept of "automated management system" began to appear in the literature. According to a two-part "Summary of Experiences" published by the central committee of the Alliance for German-Soviet Friendship, an automated line system represents "a technological complex which best realizes the processing of planning and economic information which is needed for the organization of an effective economic and administrative

management." The information system was defined there as the "core of the automated system of factory management."[104] More recently, additional and somewhat different concept definitions have arisen.[105] For instance, the Soviet scientists Isanov and Roshnov called the automated management systems a "means for the new progressive organization of management based on the fundamental perfection of solution methods for settlement of plans and other economic problems, for the determination of starting data and the technology of its processing when using modern gains in the economic-mathematic apparatus."[106]

Due to the various indications and presentations on the development and use of automated management systems, one can assume that these are viewed as the counterpart to the Management Information Systems (MIS) developed in the United States in the 1960s.

The majority of publications appearing up to the mid-1970s on the development status, examples of use and benefits of automated management systems usually give the impression of almost completely automated factory processes and significant EDP-controlled information processes in factories and central economic-administrative organs. But one should assume that many of the examples of automated management systems announced in the Soviet press are actually "Potemkin Villages," or "highly celebrated" simple EDP programs and not complex, end-use-oriented man-machine communications systems for the rationalization of management. That this type of exaggeration does in fact occur is seen from a paper by Moisseyev, "The Use of EDP Systems--Perspectives and Illusions,"[107] in which we read:

"(Until now, the experiences of the Volga Automobile Works or of the Lvov system have not been generalized.) Frequently several secondary areas, like programs for wage calculation or labor force statistics, are presented as an automated management system. But management itself remained as it was! What benefit can be expected from the solution of such secondary tasks?"

With the further evolution of electronic computing technology there also resulted new and improved possibilities for the creation of automated management systems. Nonetheless, due to the comparatively low technical level of Soviet computer engineering, the capabilities of these systems are limited. Real increases in performance resulted only with the increasing use of third-generation computers.

In the meantime, since the beginning of the 1970s, experiences gained in the USSR were also adopted by the other CEMA countries. For instance, the ASU developed into a form of EDP application binding for all these countries. The basis for the joint refinements in this area is formed by the ESER which was founded within a "Working Group ASU."[108] The first great successes of the long cooperation were presented at the Moscow ESER II/SKR Exposition in the summer of 1979.[109]

5.6.2 Primary Forms of Automated Management Systems

In the course of time, various forms of automated management systems have been developed and put into practical operation. A large part of them was presented at the ESER II/SKR Exposition in Moscow.

In Soviet literature and likewise in publications from the GDR, the following ASU are named:[110]

(1) Total or all-state systems of management (Soviet abbreviation: OGAS);

(2) Industrial branch systems, for example, automated system for branch management (OASU);

(3) Regional systems, for example, ASU of a Soviet Republic (RASU) and automated management systems of a territory (TASU);

(4) Systems to control production, also called the ASU of a factory or ASU for the organizational-economic activity of the factory (ASUP);

(5) Systems to control technological processes, automated systems for technological processes (ASUTP);

(6) Systems for automated projections (SAPR);

(7) Automated systems for financing (ASFW);

(8) Automated system of the State Committee for Labor and Wages (ASAL);

(9) Automated system of construction (ASUS) and for projections and organization of construction (ASPOS) and

(10) Automated management systems of scientific-technical processes (ASUNT). Besides these systems, there are also those for science and technology (NAUKA);[111]

(11) Automated management systems for material-technical supply (ASUMTS);

(12) Automated system for collecting and processing information (ASSOI);

(13) Automated system for collecting and processing data (ASSOD);

(14) Automated system of the State Committee for Prices (ASOU);

(15) Automated system of organizational management (ASOU);

(16) Automated system of scientific-technical information (ASITI);

(17) Automated information and reporting system (ASIS);

(18) Automated system of state statistics (ASGS) as a special national automated management system and

(19) Automated system of the State Committee for Standardization of Measurements (AIUS).

At present in the Soviet Union, there are the following automated management systems in use.[112]

(1) OGAS:

--international information system on scientific research work,
--ASU "Horizon," automated system of information processing in science and technology (Soviet abbreviation: ASINIT),
--a general state system of planning and management of material-technical supply to the economy of the USSR and
--the automated system of state statistics (ASGS).

(2) OASU:

--a system for guidance and control of the industrial branch of machine and equipment building developed jointly by the USSR, Bulgaria and Hungary and
--the OASU "Coal" for planning, settlement and management of the coal industry of the USSR.

(3) ASUP:

--the ASU Aeroflot for departing air passengers and luggage,
--the automated system for management of the Soviet production association Rostselmach, which comprises a total of 12 ASU at three different levels,
--the ASU Kamas to manage truck production, and
--the ASU Sanhygiene to control air purity in industrial regions in and around Moscow (basis: ESER-EDP system EC 1035).

(4) ASUTP:

Included herein are ASU for a heat power plant, for process control in rolling mills and for cement production based on Soviet computers of the SKR.

(5) NAUKA:

--Systems for acquisition and processing of measures results of scientific experiments;
--a system for investigation, diagnosis and convalescence in the USSR's health system.

In spite of intensive and year-long cooperation, in the individual CEMA countries different types of automated management systems have resulted, due primarily to differences in economic organization and in concept definition.

Figure 5. Automated Management Systems in the USSR

Periode (1)		1966 - 1970	1971 - 1973	(5) bis 1975	(5) bis 1979	1980
(2) spezielle ASU	ASUP	151	353	1 800	.	.
	ASUTP	170	216	700	900	.
	TASU	61	197	.	780	.
	ASSOI	13	31	.	.	.
	OASU einschl. ASU von (3) Ministerien und Ämtern	19	46	200	204	.
ASU insgesamt (4)		414	843	2 700	3 050	über 3 000

Key:

1. Period
2. Special ASU
3. OASU including ASU of ministries and agencies
4. Total ASU
5. To

Source: V. I. Maximenko: "Higher Quality Automated Systems for Management and Control." in: RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, 1979 p 5; Wolfgang Suesspeck op. cit., p 383: "The Electronic Brain of Gasprom," in: DIE WIRTSCHAFT, Berlin (East) No 26, 4 June edition, p 13, and the references of Gerd Wahner in the discussion of the Soviet publication "EDP Systems and Computer Networks" in RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 7, 1982, p 4.

5.7 The State Network of Computer Centers: The Organization of EDP Usage

The Soviet party and economic leadership was already trying to optimize the system of state economic planning. In the 1960s, work began on the development of a "uniform automation system of management and planning" and it was soon decreed that its technical basis had to be a "uniform state network of computer centers."[113] In accord with the different management and planning levels, the computer network was to have a multistage structure and it was to "offer the potential for any superior organs to receive information directly from the factories."[114] The following objectives applied for the first development concept of a network of computer centers:

(1) The network of state computer centers should have a multi-state structure and a total of three different planning and management levels; these are:

- --Computer centers of a lower level for factories, organizations and groups of factories or a territory. Their task shall be to collect and process information and to formulate it for superior economic organs.

- --Support computer centers, for example, for certain economic levels or republics, and

- --a state primary computer center for the central planning and economic organs (for example, State Planning Commission of the USSR, GOSPLAN and the Central Administration for Statistics of the USSR) with the following tasks:[115]

- --methodological initiation of all activities of the computer network, solution to national problems of ongoing and long-term planning, storage and updating of economically relevant information, creation and maintenance of an automated reporting and information system and input of instructions of central state organs into the master computer centers.

(2) Within the network of computer centers, not only vertical but also horizontal connections, are to be provided between the individual planning and management levels.[116]

(3) Finally, it was required that the network of computer stations was to be built up according to the regional and branching principle.[117]

The Central Administration for Statistics of the USSR was assigned the task of directing the creation of this network of computer centers and was thus to become concerned with "the development of an economic information system in the various members of the state network of computer centers," that is, with the development of a national management system.[118]

But this type of development goal faces problems related to the insufficient stock of computers for commercial purposes and problems arising from planning schedules during the construction of the network of computer stations.

Until about the middle of 1974, according to PRAVDA, around 1,500 computer centers were put into operation and the overall computer network was organized in accordance with the objectives. Among these computer centers were those of the factories, branch and territorial computer centers (which served "large industrial regions and large groups of factories,"[119]) the industrial-branch computer centers of the ministries and the computer centers of the central state management organs.

Within the framework of the buildup of the national network of computer centers, various organizational forms resulted for these centers. Currently there are three types:[120]

(1) Individual computer centers (such as the computer center of a large factory or of a ministry),

(2) Community computer centers and

(3) Territorial computer centers "for a large number of factories and organizations regardless of their subordination."[121]

As examples for individual computer centers we can cite the computer center of the Academy of Medical Sciences of the USSR in Moscow (with an ICL computer 2903 and others), the computer center of the Soviet information agency TASS (for example, with an EDP system from France), the computer center of the State Planning Commission of the Soviet Union, GOSPLAN (also equipped with Western computers), the computer centers of the Moscow department store GUM and of the Leningrad department store Gostiny Dvor, the computer centers of the Soviet airline Aeroflot (in Moscow, Leningrad, Kiev, Sverdlovsk and other cities) and the computer centers of large factories.

Territorial computer centers are located in Moscow, Kiev, Tashkent and Leningrad and its environs. The city of Leningrade had a total of 350 computer centers in 1978 with more than 1,485 installed EDP systems.[122] Community computer centers are normally maintained by the factories of an administrative department.

Efforts are aimed especially at promoting the buildup of computer centers for collective use (community and territorial computer centers) and to combine these into a national network of computer centers.[123] In this manner, one will be able to:

--save investment costs,
--assure the utilization of EDP capacities,
--make the information processes less complicated,
--assure an effective control of the fulfillment of plans of computer center customers and
--create favorable prerequisites for the introduction of uniform projects when developing automated management systems.

Figure 6. Computer Centers in the USSR

Year	Total number
1974	1,500
1976 (mid-year)	2,778
1980	3,000

Source: ZEITSCHRIFT RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 6, 1976, and No 7, 1982, p 4.

6. Electronic Equipment From the CSSR

6.1 Planning Goals for Electronics to 1985

Since microelectronics in the CSSR in past years had not developed in accord with the requirements, microelectronic assemblies were sometimes imported from the West "under exceptionally difficult conditions."[124] However, as the minister for the electronics industry, Milan Kubat, recently stressed, planning in the electronics sector now provides for a reduction of Western imports which will be frozen about at the level of 1980. After 1985 a further reduction of imports is possible.[125] Instead of imports, microelectronics within the country will be promoted more intensely. In close cooperation with the development programs of other CEMA countries, a target program designated Elektronika was established for the 5-year plan from 1981 to 1985. This provides for a growth of around 45 percent in the area of electrotechnology and electronics and should eliminate 300,000 jobs "through a complex introduction of microelectronics..."[126] The goal of planning to 1985 is also to meet up to 60 percent of the demand for electronic components and assemblies, especially for integrated circuits, from domestic production. As a basis for this, a "trilateral cooperation of the CSSR, USSR and GDR" is foreseen.[127] By using integrated circuits, the level of computer products will be improved.

The sole manufacturer of electronic components in the CSSR has been Tesla Roznow. From its production comes the microprocessor system MH 3000 presented at the Leipzig Spring Fair in 1979.[128] After the reorganization of the state company Tesla at the end of the 1970s, integrated circuits were produced in another Tesla factory, Tesla Piestany. Among these was the MHB 8080 A presented at the Leipzig Spring Fair in 1982.[129]

6.2 Producers of Computer Products and Research Institutes

Since the beginning of 1979 the computer industry of the CSSR has had a new organizational structure. On 1 January the Combine for Automation and Computer Engineering in Prague (Zavody automatizace a vypocetni techniky, ZVT or ZAVT was founded. It consists of the factories active in the sector of electronic computing machines and also a series of new factories.[130] A corresponding reorganization was also performed in the area of electronics in the GDR in 1977-1978. Here too this was to bring not only effective successes in planned automation of industry but also an intensive economic growth.

The organizational structure of the combine contains the following regions:

(1) Research and Development:

--Research Institute for Mathematic Machines in Prague (VUMS),
--Research Institute for automation in Prague (VUAP),
--Research Institute for Computer Engineering in Zilina (VUVT),
--Institute for Applied Computer Engineering in Prague (UAVT);

(2) Production Factories:

--Factories for industrial automation in Cakovice with the ZPA-Prague (Zavody Prumyslove Automatizace)-Vysocany;
--ZPA Prague-Jinonice with factories in Pecky, Nova, Paka, Usti n/L, Jicin and Netolice;
--ZPA Prague-Kosire with a factory in Decin;
--Aritma Prague with the factories in As and Horice;
--the plant for laboratory instruments in Prague with factories in Chotutice and Polna;
--Pragotron Prague with a factory in Kosice;
--Zbrojovka plant in Bruenn with factories in Vyskov and Prosec;
--Plant for computer engineering with the Namestovo factory in Banska Bystrica;
--Metra Blansko with factories in Bruenn, Linhartice and Sumperk;
--ZPA Trutnov;
--ZPA Dukla, Presov and
--ZPA Novy Bor.

As was also reported, the operations from the Zbrojovka and Tesla plants "with their previous organization, production program and pertinent delivery and cooperation agreements" were converted into the new combine ZVT.[131]

(3) Sales and Customer Service:

Within the CSSR there are two organizations for delivery installation and customer service in the area of computers (ESER and SKR).

--in the CSR the national company Kancelarske stroje and
--in the SSR the national company Datasystem.
--For the delivery of "complex systems to control technological processes," however, the ZPA Dodavetelsky podnik is responsible.[132]

The ZVT combine produces:

--Data processing systems of ESER and SKR (ESER model EC 1025, ESER development series 2, SKR models CM 3-20 and CM 4-20;
--Microcomputers and microcomputer systems;
--Analog and hybrid computers (for example, analog computer MEDA 43 HA, ADT 3000, etc.);
--Peripheral equipment (ESER and SKR);
--Facilities for data processing;
--Equipment and devices for testing
--Office machines and typewriters (products designated "Consol");
--Duplication equipment;

--Systems and equipment for automatic regulation and control;
--Measuring and recording equipment and
--Scientific and laboratory instruments.

The exporter of these products and of other products (for example, information processing, industrial automation equipment, polygraph machines, measuring and automation systems, etc.) is the foreign trade company KOVO in Prague.[133]

For some time the research center in Pressburg (Yyskumne vypoctove stredisko, VVS) has been active in computer research. Among its main activities are work on structuring information relationships using computers within the frame of an "integrated statistic information system" and on problems of EDP application.[134]

6.3 Exhibits at the Fair

As in the preceding year, the KOVO exhibit in Leipzig was dominated by electronic products.[135]

--From the production of the State Tesla Company, various circuits were presented, including the 8-bit microprocessor MHB 8080 and dynamic 16-K-bit RAMs.[136]

--From the area of electronic computers, KOVO presented the small computer system SM 4-20 (microcomputer with 16-bit processor, a constituent of the system of small computers, SKR of the CEMA countries) with graphic display and the graphic data station CM 7405 with vector screen.

In Hannover, KOVO exhibited:[137]

--the SM 4-20 computer system with corresponding periphery from the plant in Banska Bystrica,

--various types of typewriters (Consul typewriters) from the Zbrojovka plants in Bruenn,

-duplicating equipment from CYKLOS URBANICE and

--card-punch equipment by ARITMA Prague (model Aritma 2050-EC 6112).

7. Bulgaria: A Small Country With a Large Product Range

7.1 The Development of Microelectronics

In 1964 Bulgaria began the production of semiconductor elements under French license. Toward the end of the 1960s, MOS-based[138] transistors were developed and produced.[139] Concerns active at that time on the production section were finally combined in 1970 into a national industrial organization called the Economic Alliance of Electronic Components.[140] In 1976 the Institute for Microelectronics was founded in Sofia in order to meet the recognized needs of this new technology based on specific research and development work. In the

meantime, Bulgaria has begun producing integrated circuits. They are produced mainly to meet domestic needs and are used in data processing systems, robot controls, small and pocket calculators and in consumer-oriented electronic goods. Among the microprocessors are the 4-bit CPU CM 402 (series 400) and the 8-bit CPU CM 601 (series 600).[141] Microprocessors and other integrated circuits mark a new generation of electronic computer engineering in Bulgaria since the beginning of the 1980s. Among the new products are the text-processing system ISOT 1002 C, the data acquisition unit EC 9112 (ESER product) or the data processing system ESTEL 4.

For further development of EDP to the year 1985, the guidelines of the ministry for electronics and electrical engineering have set the following goals:[142]

--use of computer-aided systems for production control in all branches of industry and
--building of hierarchial computer systems in industry.

7.2 The State Economic Union ISOT: Producer of Computer Products

When building up its own EDP industry, Bulgaria was heavily supported from the beginning by the USSR and over time a close cooperation developed between the two countries, both because of special mutual agreements and also because of the multilateral government commission for the ESER and SKR programs.[143]

The "management organ for the development, production, export and technical management of EDP systems and of organizational aids" is the "State Economic Alliance ISOT at the ministry for electronics and electrical engineering" (SWV ISOT) founded in 1971 and headquartered in Sofia.[144] The ISOTIMPEX foreign trade agency belonging to ISOT is responsible for the import and export of electronic computing products.

7.3 Specialization and Work Division in CEMA Determine the Production Program of ISOT

Within ESER and SKR, Bulgaria has concentrated on the production of certain products because of the agreed work division and specialization. These are, in particular, magnetic storage devices produced by ISOT not only for its own needs but also for other CEMA countries.

The production program of the SWV ISOT currently comprises:[145]

(1) Electronic data processing systems of ESER, to wit, the EDP system EC 1035 (series 2 of ESER) developed jointly with the USSR.[146]

(2) Control units for magnetic tape storage from the ESER product line (for example, EC 5561 and EC 5512).

(3) Small computers of the model ISOT 310 for automation and control of production processes in real time and for commercial use.

(4) Peripheral memory units for ESER and SKR computers, for example:

--Magnetic tape units (ESER),
--Moving head disks (ESER),
--Moving head stack (ESER),
--Small disk memory (ISOT 370),
--Moving head disks (SKR) and
--Floppy disk memories.

(5) Data acquisition equipment, to wit:

--the magnetic tape data acquisition unit EC 9002,
--the data collection system EC 9003,
--the data collection system EC 9112 with output on floppy disk (microprocessor based) and
--the data acquisition device EC 9113 with output via the ISOT 5003 magnetic tape unit (microprocessor based).

(6) Data processing products. The data processing systems designated ESTEL have been developed and produced over some time.

(7) Electronic table and pocket calculators.

Bulgaria was the first CEMA country to begin production of pocket and table calculators. These products are intended for very different kinds of uses and are offered under the trade name ELKA.

(8) Technological systems and equipment for automation of production.

Among these are, for example, control disk packs (ESER product EC A527), computer controlled systems for end-control of magnetic disk memories or disk packs, etc.[147]

(9) Microprocessor-based text manipulation systems (ISOT 1002 C)

(10) Microcomputers bearing designation ISOT 0220.

These microcomputers are of mudular design and are composed of the microprocessor module, the I/0 module, the working memory module and the ROM module. In 1980, 200 of these systems were produced in the factory for Organization Engineering in Silistra.[148]

(11) Microprocessor-based accounting and invoicing machines (ISOT 0250).

7.4 Computer Products at the Fairs in Leipzing and Hannover

Both in Leipzig and in Hannover, the foreign trade company ISOTIMPEX presented Bulgarian electronic products. Among the products shown at the Leipzig Spring Fair were:[149]

--the minicomputer ISOT 1016 C of modular design as a refinement of the minicomputer CM 4 (system of small computers, SKR),
--the automatic savings account system ISOT 1500 C,

--the small computer ISOT 1003 C,
--the magnetic tape system EC 9004 (ESER product),
--100-M-byte device, model EC 5067.0, and
--modems and terminals.

But the range of products shown in Hannover was less extensive.[150] In addition to typewriters, only magnetic and magnetic-tape memories were exhibited as products from the system of small computers.

8. The Situation of Polish EDP

The comparatively numerous activities of Poland in the area of electronic computer engineering have been greatly reduced in recent months. Even last year there was a definite lag at the fairs. No doubt the effects of the general economic crisis in Poland have been reflected in the capabilities of the industrial alliance MERA, the main source of Polish EDP production.[151]

8.1 The EDP Industry and Its Capabilities

The Industrial Alliance for Automation and Measuring Instruments, MERA, is composed of a total of 19 production operations, two scientific institutes, two projection agencies and two trade companies. Among the industrial alliance's members is the foreign trade company, METRONEX, which handles export and import of industrial measuring and control instruments and of computer products.[152]

In the FRG the interests of MERA are represented by the German-Polish Machine Trade Company mbH [Limited] (DEPOLMA) founded in May 1966 in Dusseldorf.[153]

Among the MERA plants are:

(1) MERA BLONIE, Zaklady Mechaniczno-Precyzyjne in Blonie

The production program includes:

--the minisystem MERA-2500 with functional units CPU, internal memory (with 8-K-byte ROM, REPROM, 8-K-byte memory RAM), external memory with floppy disk, printer, keyboard and control units;

--the microcomputer MERA-60;

--the office computer MERA-100, and

--various printer types.

(2) MERA-PNEFAL, Przedsiebiorstwo Automatyki Przemyslowej (Company for Industrial Automation), Warsaw

The MERA-PNEFAL plant is the producer of microcomputer-based systems for automation of industrial processes, for example, the CAMAC-SETs.

(3) MERA-PIAP, Przemyslowy Institut Automatyki i Pomiarow, Warsaw

This institute is the manufacturer of so-called microprocessor-base facilities such as the Inteldigit Pi and Monitors.

(4) MERA-ELWRO, Centrum Kimputerowych Systemow Automatyki i Pomiarow, Wroclaw (formerly Breslau)

Among the most important products of the MERA-ELWRO plant are:

--Analog automation components,
--ODRA-series computers,
--Small computers (SKR) of the CEMA countries,
--ESER-EDP systems, type EC 1030 (cooperatively with the USSR)[154] and
--Desk computers.

(5) MERA-ZSM, Zaklady Systemow Minikomputreowych, Warsaw

The most important products are, for example:

--the model MERA-300 office computers, and
--model MERA-400 small computer systems.

(6) MERA-ELZAB, Zaklady Urzadzen Komputerowych, Zabrze

The MERA-ELZAB plant products:

--Display stations MERA 7980 (in Stansaab license),
--Terminal systems MERA 7900 (in Stansaab license) and
--Punched-tape stations SM 6204 (system of small computers, SKR).

(7) MERA-Ster, Scientific Production Center of Control Systems

Among the most important products of this production center are the model MERA-60 minicomputer systems. These minicomputer systems are equipped with Soviet microprocessors.[155]

8.2 Integrated Circuits of UNITRA-ELEKTRON

A manufacturer of electronic components, including integrated circuits, is the Union of the Industry for Subassemblies and Electronic Materials, UNITRA-ELEKTRON, founded in 1978. A total of 11 industrial firms, including 4 scientific production centers belong to it. The production program of UNITRA includes various types of diodes, transistors, thyristors and around 170 types of integrated circuits.[156] The test unit TEUTES-1 was developed specifically for testing integrated circuits by the Warsaw Institute for Industrial Automation (Institut Automatyki Przemslowej). It can be used for all IC technologies.[157]

8.3 Exhibits at the Fairs in Leipzig and Hannover

The range of products exhibited at the Leipzig Spring Fair was not very extensive.[158] Most of the products had long been known from the MERA production program. The MERA-400 computer was shown for the third time, but this time as a user example for a special, operating information system. The MERA-400 computer is a two-processor system which can perform up to 500,000 operations/ per second.

In addition, displays and disk storages were shown.

But the METRONIX products exhibited in Hannover were much more comprehensive than in Leipzig. Among the products were:

--the miniprint system MERA-2500, consisting of the CPU (with Intel CPU 8008), internal memory, floppy disk memory for two diskettes (8 bits each), printer, keyboard and control units;

--the terminal system MERA-7952;

--the microprocessor-controlled needle-printer D-200 (180 characters/per second) and

--typewriters.

8.4. Aid From the Soviet Union

The fact that Poland will deliver around 200 MERA-60 microcomputers this year to the USSR is considered to be not only an act to support the electronics industry during a time of economic bottlenecks and mishaps in Poland but also as a requirement to cover their own needs. As the Polish information agency PAP reported, these are services amounting to 850 million zloty and thus is one of the largest contracts ever obtained by the Polish electronics industry.[159] Another preliminary agreement for the years 1983 to 1985 also provides for annual delivery of about 300 of these micros for a total value of around 4.5 billion zlotys.[160]

In 1980 around 100 computers were exported to the USSR.[161]

9. The Capabilities of the Romanian Computer Industry

9.1 Current Developments in Electronic Computer Technology

The development of electronic computing equipment in Romania has been characterized from its beginning by a close cooperation with Western firms. The close cooperation with the French Compagnie International pour l'Informatique (CII) was primarily responsible for Romanian computer engineering. For example, computers of the Felix series were produced on the basis of CII licenses. But the American Control Data Corporation (CDC) has been active in Romania since the beginning of the 1970s. On 4 April 1973 an agreement was concluded between the CDC and the Industrial Central for Electronics and Computer Engineering (CIETC), Bucharest,

to found a joint venture, ROM CONTROL DATA (RDC).[162] The agreement provided for the production of peripheral equipment by this new company.[163] By this strong Western orientation, Romania has clearly shown which path it has chosen to take in the area of electronic computer engineering. It was a path that stresses less Romania's cooperation in ESER and more its own national interest. The primary characteristic of this development is the fact that Romania did not enter ESER until after about 1976. In contrast to the other CEMA countries (except Cuba), Romania has remained without any of its own ESER contributions due to its late entry to ESER.[164] The various, long-term fixed tasks in research, development and production to be performed within the framework of a strict work division were assigned at an early date to countries participating in the foundation of ESER. But Romania was active since 1974 in the area of small computers (SKR). In the course of further developments, the planning goals set for 1980 placed greater emphasis on domestic developments. In the period from 1981 to 1990, the percentage of domestic developments should grow by 80 to 90 percent.[165] Microelectronics has doubtless been responsible for the development of computer engineering in Romania since the end of the 1970s. Especially in Romania, a decisive change in previous negative economic growth is anticipated from an increased development of microelectronics and the use of related technologies.[166]

9.2 The Computer Industry

In Romania, electronic data processing systems are produced under the direction of the Industrial Central for Electronics and Automation (Centrala Industriala de Electronica si Automatzari, CIA, headquartered in Bucharest. The Company for Electronic Computing Machines (with plants in Bucharest and Sighesoara) and the Company for Data Storage in Timisoara are subordinate to the Central. The companies ELECTRONMURES and AUTOMATICA in Bucharest are also concerned with the production of computer hardware. But the following institutions are active primarily in the area of research and development:

--The Research and Projections Institute for Automation (Institutul de Projectaripentru Automatizari, IPA), which is concerned generally with the development of equipment for the automation of industrial processes and

--the Research and Projections Institute for Computer Engineering (Institutul Pentru Technica de Calcul Bukarest, IPC), which is active in the area of EDP hardware.

The Council for Economic and Social Organization (COES) was founded in 1972 to provide for the most effective use of electronic computer engineering. To implement the pertinent, multifaceted tasks connected with this (controls and coordination of the use of EDP), COES relies on its subordinate Central Institute for Management and Automation (Institutul central pentru conducere si informatica, ICI).[167]

In Romania the foreign trade company ELECTRONUM in Bucharest is responsible for the import and export of computer products.

9.3 The Most Important Products of Computer Engineering and at the Fair Exhibits

The computer industry of Romania presently produces a broad assortment of systems and equipment. Among these are:

--the programmable controls, microcomputer-based AP 101 and AP 107, for example, for industrial robots;
--the minicomputer INDEPENDENT 102F;
--the minicomputer I-100 of modular design (8-bit computer with microprogram memory) and the minicomputer I-102 F;
--the microcomputer system M 118 (double processor, 8 K EPROM and 2 K RAM) with periphery;
--small computer, model Coral 4001, for OEM applications;
--small computer, model Coral 4011 (with 16-bit processing, 600,000 operations/ per second) and
--"Felix-family" computers, for example, the EDP system Felix S-32-P.

The foreign trade firm ELECTRONUM presented relatively new products at the Leipzig and Hannover fairs. There were, among others, minicomputers (Independent 102 F), small computer systems (M 118 and I-102 F), data acquisition and processing terminals, peripheral equipment for data processing and programmable controls (AP 101).[168]

10. EDP in Cuba

10.1 EDP Developments

The first EDP system was installed in Cuba in 1963. This was an Elliot 803B from England. The domestic development of EDP in Cuba actually began in about 1969 with the formation of a group of EDP technicians at the University of Havana to develop Cuban computer systems, especially for use in the sugar industry.[169] After Cuba became a new member of CEMA in July 1972 (the ninth full member of CEMA), it entered the "Governmental Commission for the Cooperation of Socialist Countries in the Area of Computer Engineering" in December of the same year; it thus joined ESER.[170] At that time Cuba decided to become more active in the EDP sector and founded the National Institute for Automated Systems and Computer Engineering at the Ministrial Council in Mantanzas.[171] Both research and development and production of computer systems, including periphery and the development and preparation of computer software, are subordinate to this institute.

Later, after 1974, Cuba also participated with its own entries in the system of small computers of the CEMA countries. In spite of such activities, Cuba has remained a "developing EDP country" and was thus reliant entirely on the support of other CEMA countries in building up its own EDP production units and equipping its own industry with electronic computing systems. For example, the USSR delivered EC 1020 and EC 1022 ESER computers, and the GDR delivered EC 1040 ESER computers to Cuba.

Since about 1976 Cuba has produced its own computer systems on a small scale; these bear the designation CID. These were initially the small computer CID 201b, of which 86 units were produced by the beginning of 1977.[172]

By the end of 1976, 101 computer systems were installed in Cuba: two large computers (ESER-EDP systems), two medium-size EDP systems, 11 small computers and 86 of the smallest computers (CID-201b) from domestic production.[173] In 1978, according to Cuban reports, "more than 150 CID-201b computer systems were installed in Cuba."[174] These and other systems and peripheral equipment were presented the following year at the spring fair in Leipzig. But Cuba was also represented with its own entries at the Moscow ESER II/SKR Exposition in 1979. In addition to its CID small computer, it presented the "Republic of Cuba" Automated Management System. This computer-based, multiline level management and information system consisted of "a network for data processing in the sugar industry (DATASUKAR), the automated system SIDUKAR and an automated system at the operations level."[176]

10.2 EDP Products

Cuban EDP products usually appear under the type designation CID. Among them are:

--the smallest computer CID-201b,
--the computer CID 300 (CM 2303),
--microcomputers CM 50/40-1 and
--video terminals CID 702 (CM 7302)

From these products came the design and production of the computers CID 300 and CM 50/40-1 and the video terminal CID 702 in cooperation with the CEMA countries participating in the system of small computers (SKR). As SKR products, they also bear an SKR identification.[177]

The microcomputer CM 50/40-1 was presented as the newest domestic development and as a new contribution to the "computer program of the socialist countries" at the Leipzig Spring Fair this year as the Cuban exhibit.[178]

11. Electronics Development Goals of the CEMA Countries

In all CEMA countries the activities of the parties and governments are aimed at making increased use of the potentials of the newest technologies, especially microelectronics, robot engineering and EDP, to accelerate economic growth.[179] Accordingly, the perfection of cooperation in the area of science, engineering, and production and the refinement of key technologies was a central theme at the 36th Consular Convention of the CEMA countries in Budapest.[180] The NEUES DEUTSCHLAND of 11 June 1982 reported that the following agreements were signed:

--"a general agreement on multilateral cooperation for development and broad utilization of microprocessor engineering in the state economies of the members of the CEMA,"

--a "general agreement" by Bulgaria, Hungary, the GDR, Poland, Romania, the USSR and CSSR "on multilateral cooperation in the development and organization of specialized and cooperative production of industrial robots," and finally

--"an agreement on multilateral international specialization and cooperation in development and production of products of microelectronics for computers, for special technological facilities and high-purity materials for microelectronics."[181]

Without doubt at this convention the problems arising from debts to the West and the search for ways of solving them were discussed. Certainly by further intensification of economic cooperation and by reinforcing efforts toward indepedence from the West through intensification of domestic economic potential and competitiveness, possible solutions could be seen. For instance, the goals for some time have been aimed not only at increasing economic growth through intensive development of innovative technologies and their effective use but also at securing tangible successes in Western markets through technology exports.[182]

The "increase in profitable exports" is among the goals of the 5-year plan 1981-1985 of the GDR.[183] Producing and readying microchip-based systems and equipment will contribute toward realizing this goal.[184] This type of export success can, however, only be realized if one can convincingly offer a capable technology, recognize market opportunities and fully utilize the resulting possibilities, as has been demonstrated by Videoton with its airport reservation system.[185] The Hungarian strategy is also made up of cooperation with Western partners. The Hungarians are well aware that one cannot rest on achieved successes. For instance, the general director of the Videoton combine, Istvan Papp, stated, "In order to retain our share of the international market under the more complicated conditions, we will have to expand the intellectual capacity of our combine significantly," and he pointed out that at present at Videoton there is no product older than 3 1/2 years.[186]

But for the GDR operational testing of its EDP products on the world market is still pending. Of course Robotron has since begun production of a series of quite capable products, but this combine has not broken into the Western market in spite of numerous efforts. But in order to increase the share of world marketable products and to improve export earnings, the development and perfection of science and technology in the GDR enjoy the highest priority.[187]

FOOTNOTES

1. Regarding the fairs in Leipzig and Hannover, see also Klaus Krakat; "DDR auf der Leipziger Fruehjahrsmesse um Profilierung bemueht: Schluesseltechnologien sind auf dem Vormarsch" [GDR at the Leipzig Spring Fair Concerned With Image: Key Technologies on the Advance], COMPUTERWOCHE, Munich, No 22, 28 May 1982, pp 36 and 37, and Klause Krakat; "Comecon-Laender auf der Hannover-Messe: "Die DDR und Ungarn bestimmten das Angebot" [CEMA Countries at the Hannover Fair: The GDR and Hungary Determined the Product Offerings], COMPUTERWOCHE, Munich, No 24, 11 June 1982, p 25.

2. From 14 to 20 March 1982.

3. International Fair, Hannover, from 21 to 28 April 1982.

4. See also Bardo Diehl, "Die EDV Konzeption der DDR setzt sich im RGW durch" [The GDR's EDP Concept Prevails in CEMA], DEUTSCHLAND ARCHIV, Cologne, No 2, 1981, p 146, and also Klaus Krakat, "Comecon-Laender im CeBIT: Elektronikkombinate wollen ins Westgeschaeft" [CEMA Countries in the CeBIT: Electronics Combines Desire To Enter the Western Market], COMPUTERWOCHE, Munich, No 19, 8 May 1981, p 14.

5. See also the presentations in HETI VILAGGAZDASAG, No 24, 13 June 1981, pp 38-39; "EMU 11," product information from MTA KFKI, Institut fuer Mess- und Rechentechnik in Budapest zur Leipziger Fruhjahrsmesse 1980; "Sam 80," product information from MMG Automatika Muevek in Budapest zur Leipziger Fruehjahrsmesse 1979.

6. See also the notes of the director of the Robotron State Center for Research and Technology. Gerhard Merkel; "Stand und Perspektiven in Entwicklung und Nutzung der Rechentechnik in der DDR" [Status and Perspectives in Development and Use of Computer Engineering in the GDR], "Entwicklung und Anwendung der elektronischen Rechentechnik in the DDR, Schriftenreihe Informationsverarbeitung, Herausgeber: VEB Robotron Zentrum fur Forschung und Technik Dresden," Berlin (East), 1976, pp 43, 44. As a supplement, see also Bardo Diehl, op. cit., p 145.

7. According to J. A. Fedotov, "Halbleiterelektronik in der UdSSR" [Semiconductor Electronics in the USSR], RADIO FERNSEHEN ELEKTRONIK, Berlin (East), No 19/20, 1977, p 620.

8. See also especially the pertinent references in Analog Circuits Table of the USSR and Foreign Firms, ELORG, Moscow, 1978, and in: "Integrated Circuits Catalog," ELORG, Moscow, 1978.

9. See also "Umfassender Einsatz von. Industrierobotern" [Extensive Use of Industrial Robots], PRAVDA, 9 August 1980, reported on PdSU (Press of the Soviet Union), Berlin (East), No 18, 8 September 1980, p 18; M. N. Chmelnizki, "Ausstattung von Schmiedepressmaschinen mit Steuerungen und elektronischen Vorrichtungen," [Equipping Forging Machines With Controls and Electronic Devices]. KUSNETSZHNO-SHTAMPOVOTSZHOJE PROISVODSTVO, No 7, 1980, reprinted in PdSU, 2 December 1980, No 24, pp 25-26; "Nachwuchs fuer Industrieroboter" [Growth in Industrial Robots], PRAVDA 26-27 April 1981, reprinted in PdSU 2 June 1981, No 12, pp 13-14, and "Industrieroboter zum Handhaben von Werkstuecken" [Industrial Robots for Manipulation of Workpieces], in "Materialien der Volksausstellung der UdSSR 1981," reprinted in PdSU, 2 March 1982, No 6, pp 27-28.

10. On West-East technology transfer, see Josef C. Brada, "Technologietransfer zwischen West und Ost" [Technology Transfer Between West and East], OSTEUROPA, Stuttgart, No 4, 1981, pp 297-312, No 5, 1981, pp 408, 425 and No 8, 1981, pp 637-658; G. Bertsch, R. Cupitt, J. R. McIntyre, M. Steiner: "East-West Technology Transfer and Export Controls," OSTEUROPA-WIRTSCHAFT, Stuttgart, No 2, 1981, pp 116-136, and Klaus Krakat, "Einseitiger West-Ost Technologie Transfer zum Vorteil fuer den Comecon" [One-sided West-East Technology Transfer to the Advantage of Comecon], FS-ANALYSEN, No 4, 1981.

11. Regarding electronic features in space engineering, see also B. Pokrowski: "Elektronisches Fliessband mit Lichtgeschwindigkeit" [Electronic Flow Tape at the Speed of Light], PRAVDA, 29 March 1981, reprinted in PdSU, Berlin (East), 2 May 1981, No 10, p 36.

12. See also in particular the presentation in the Zeitschrift DDR Aussenwirtschaft (AW), Messebulletin, Leipziger Fruhjahrsmesse 1982, No 12/3, pp 1 and 4.

13. See also "Leipziger Fruhjahrsmesse 1982. VEB Carl Zeiss JENA" [Leipzig Spring Fair 1982. State Enterprise Carl Zeiss, JENA] in NACHRICHTENTECHNIK-ELEKTRONIK, Berlin (East), No 7, 1982, pp 306-307.

14. Compiled from the information pamphlet "Robotron '82," VEB Kombinat Robotron Dresden, and special fair information sheets and product descriptions of the VEB Kombinat Robotron Dresden.

15. Consumer entertainment products are also produced in the GDR by the VEB Kombinat Rundfunk und Fernsehen Stassfurt. This combine is considered to be the actual main producers of entertainment electronics in the GDR due to its extensive product assortment. Production of entertainment electronics products began at Robotron after the Eighth Party Congress of the SED in June 1971. See also "Produkte, die ins Profil passen" [Products Which Fit the Profile], conversation with the general director of the VEB Kombinat Robotron Dresden, Sieber, in DIE WIRTSCHAFT, Berlin (East), No 6, 1982, p 10.

16. See also Werner Schulze, "Grundkonzeption des Erzeugnisprogramms 'Dezentrale Datentechnik,'" [Basic Conception of the 'Decentral Data Engineering' Product Line], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 9, 1980, pp 7-10. Regarding the "Decentral Data Engineering" product program, see also Klaus Krakat, "Neuere Tatbestaende der Mikroelektronik" [New Circumstances in Microelectronics] in "Wirtschaftswachstum in Theorie und Praxis des DDR-Systems," 7th Symposium der Forschungsstelle, Referate on 20 November 1981, FS-ANALYSEN, No 9, 1981, pp 99-102.

17. See also Werner Schulze: "Grundkonzeption des Erzeugnisprogramms 'Dezentrale Datentechnik,'" op. cit. pp 7ff, and "Die dezentrale Datentechnik des VEB Kombinat Robotron--ein modulares Konzept von Geraetetechnik und Systemunterlagen" [Decentral Data Engineering of the Robotron Combine--A Modular Concept of Equipment Engineering and System Documentation], NEUE TECHNIK IM BUERO, Berlin (East), No 2, 1981, pp 33-38.

18. As in "LFM 1981, Mikrorechner--Basis leistungsfahiger Erzeugnisse und Anwenderlosungen" [LFM 1981, Microcomputers--The Basis of High-performance Products and Applied Solutions], RECHENTECHNIK/DATENVERARBEITUNG, Berlin, (East), No 5, 1981, p 27.

19. OEM is the abbreviation for Original Equipment Manufacturer, producer of equipment installed in other systems.

20. See also the appropriate fair information from the "robotron '82" information packet of the VEB Kombinat Robotron Dresden for the Leipzig Spring Fair, 1982.

21. See also in particular a 12-page Robotron information pamphlet "Mikrorechnersystem zur Bestrahlungsplanung robotron DOPSY, VEB Robotron Zentrum Fuer Furschung und Technik Dresden." In the pertinent GDR literature the designation "dipsy-r" is also used for this cancer irradiation planning system.

22. M means Mega; Mbits/ means megabit per second (1,000,000 bits/s); a floppy disk is a flexible magnetic disk used with appropriate drive as a direct access memory in data processing (floppy disk = diskette = foil disk memory).

23. See also Press Information, Leipzig Spring Fair 1982 from 14 to 20 March, Branchenbericht Datenverarbeitungsanlangen, Office machines, op. cit. pp 5 and 6, and "Leipziger Fruhjahrsmesse 1982: Leistungsfahige Rechentechnik/neuartige Anwendungslosungen/arbeitsplatzbezogene Datenverarbeitung" [Leipzig Spring Fair 1982: High-performance EDP Systems, Applied Solutions], Berlin (East), No 5, 1982, p 20, and "Leipziger Fruhjahrsmesse 1982" [Leipzig Spring Fair 1982], RADIO FERNSEHEN ELEKTRONIK Berlin (East), No 6, 1982, p 360.

24. Other references in "Leipziger Fruhjahrsmesse 1982: Leistungsfahige Rechentechnik/neuartige Anwendungslosungen/arbeitsplatzbezogene Datenverarbeitung," op. cit., pp 20 and 21.

25. See also "Leipziger Fruhjahrsmesse 1982: Leistungsfahige Rechentechnik/ neuartige Anwendungslosungen/arbeitsplatzbezogene Datenverarbeitung," op. cit., p 19, and Press Information, Leipzig Spring Fair 1982 from 14 to 20 March, Branchenbericht Datenverarbeitungsanlagen, Buromaschinen, op. cit. pp 3 and 4.

26. See also Press Information, op. cit., p 6.

27. See also "GDR at the Hannover Fair 1982," in "Fair Information Sheet," p 4.

28. See also the brief information, "Robotron: Computer Irradiation," COMPUTERWOCHE, Munich, No 16, 16 April 198], p 47, and "GDR at the Hannover Fair 1982," op. cit., p 4.

29. Regarding the MARMEDO software packet presented by Robotron last year at the SYSTEMS in Munich, see "MARMEDO, subsystem description," Robotron information sheet and also "DDR Orgware 'Marmedo': Systemlosungen fur medizinische und administrative Prozesse" [GDR Software Marmedo: Sytstem Solutions for Medical and Administrative Processes], COMPUTERWOCHE, Munich, No 47, 20 November 1981, pp 10 and 11.

30. See "GDR at the Hannover Fair 1982," op. cit., p 4.

31. Detailed references are found in "Angebotskatalog Branchenorientierte Software" (43 pages) status: 15 January 1981, VEB Kombinat Robotron Dresden, and "You can always count on ROBOTRON," information sheet of the Robotron Combine, Dresden.

32. See also in particular the discussion in Leipziger Messe, Deutsche Demokratische Republik, 14-20 March 1982--Fachvortrage, programmpunkt 6 "Datenverarbeitung," p 23.

33. Referatsthema: "Das Leitungsinformationssystem Robotron--eine komplexe rechentechnische Losung" [The Management Information System of Robotron--A Complex Computer Engineering Solution] Ed.: Dipl-Ing, oec. Bernhard Malsch, director for organization and data processing in the State Robotron Center for Research and Engineering, Dresden. Regarding the concept of a management information system for the "management level of the ministry for coal and energy," see Klaus Tornus and Hans Roener, "Aufbau und Gestaltung rechnergestuetzter Leitungsinformationssysteme" [Design and Structure of Computer-based Management Information Systems], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 2, 1981, pp 30-34.

34. Robotron information: Robotron-Rechentechnik fuer Leitungsinformationssysteme [Robotron Computer engineering for management information systems], VEB Combine Robotron Dresden, 1982.

35. The "Automatisierten Systeme der Informationsverarbeitung fuer die Leitung und Planung" [automated systems of information processing for management and planning, or "ASU"] first developed in the USSR were also introduced into the other CEMA countries. They are approximately equivalent to the known Management Information Systems (MIS) introduced into the FRG at the end of the 1960s. In the GDR, "automated management systems (ALS)" were developed with reference to Soviet concepts and have been introduced into various factories and combines. See also Klaus Krakat, "Computerproduktion und Computereinsatz in the DDR," FS-ANALYSEN, No 3, 1977, pp 49-53.

36. See also Gerd Rossa; "Entwurfsmethodik von rechnergestuetzten Infomrationssystemen mit Mikrorechentechnik" [Design Methods of Computer-based Information Systems With Microcomputers], RECHENTTECHNIK/DATENVERARBEITUNG, Berlin (East), No 4, 1982, pp 7-9.

37. See "Umfangreiche Geschaefte auf der Frheujahrsmesse. Qualitatsprodukte unserer Industrie in viele Laender" [Extensive Business at the Spring Fair. Our Industry's Quality Products in Many Countries], NEUES DEUTSCHLAND, Berlin (East), 19 March 1982, p 1.

38. See "Export und Importgeschaefte mit vielen Handelspartnern" [Export and Import Business With Many Trade Partners], NEUES DEUTSCHLAND Berlin (East), 20-21 March 1982, pp 1-2.

39. Ibid.

40. In December 1969 the GDR, Hungary, Poland, the CSSR and Bulgaria under the direction of the USSR concluded a governmental agreement on the work division of development and production of EDP systems, peripheral equipment and pertinent system documentation within the frame of a "uniform system of electronic computer engineering (ESER)." Romania and Cuba entered this agreement at later dates. See also M. Rakowski, "Das einheitliche System der elektronischen Rechentechnik" [The Uniform System of Electronic Computer Engineering], PdSU, Berlin (East), No 22, 1973, p 17, reprinted from SOZIALISTITSCHESKAJA INDUSTRIYA, 5 May 1973, and Klaus Krakat, "Development Status and Directions in Electronic Data Processing in the CEMA Countries. Part 1: The Uniform System of Electronic Computer Engineering," FS-ANALYSEN, No 7, 1981.

41. Regarding the system of small computers of CEMA countries, see Klaus Krakat, "Development Status and Directions in Electronic Data Processing in the CEMA countries. Part 2: Small Computer Systems," FS-ANALYSEN, No 1, 1979, and as a supplement to this, B. H. Naumov, "Kleinrechner und Perspektiven ihrer Entwicklung. Die Arbeit der Sozialistischen Laender auf dem Befiet der Kleinrechner" [Small Computers and Perspectives on Their Development. The Work of the Socialist Countries in the Area of Small Computers], in "Entwicklung und Anwendung der Elektronischen Rechentechnik in the DDR. Schriftenreihe Informationsverarbeitung," op. cit., pp 133-143.

42. See "Ungarn gruendet Produktionsgesellschaft fuer ICs: Entwicklungsprogramm" [Hungary Founds Production Company for Ics. Development Program], DIE COMPUTERZEITUNG, Munich, No 10, 21 April 1982, p 51.

43. IC is the abbreviation for integrated circuit.

44. See also Klaus Krakat, "Die EDV systeme der RGW Laender, Teil 2, Ungarn: Zentrales Entwicklungsprogramm auf Erfolgskurs" [The EDP Systems of the CEMA Countries. Part 2, Hungary: Central Development Program on the Road to Success], COMPUTERWOCHE, Munich, No 40, 29 September 1978, p 10.

45. See also "Die Werktaetigen von Videoton und Robotron in guter Partnerschaft" [The Employees of Videoton and Robotron in a Good Working Relationship], NEUES DEUTSCHLAND, Berlin (East), 4 June 1982, p 3 and also p 1.

46. See also the additional special information of this institute, including "Automatisiertes Planungssystem fuer Landwirtschaftliche Betriebe, Systembeschreibung" [Automated Planning System for Agriculture, System Description] and "Automatischer Entwurf gedruckter Platten mit dem Programmsystem Kt 15" [Automatic Design of Printed Disks with the KT 15 Program System], etc.

47. A special fair pamphlet provides information about the entire field of activity of this institute (Hannover Fair 1982).

48. See also the information found in Systementwicklung bei SZAMOK.

49. See also in this regard "Leipziger Fruhjahrsmesse 1982: Leistungsfahige Rechentechnik," op. cit., pp 22 and 23; VIDEOTON-COMPUTER, information sheets of Videoton, Budapest; and press information, Leipzig Spring Fair 1982, from 14 to 20 March. State report, Hungary.

50. See special fair information sheets and product descriptions of Videoton.

51. See also "Videoton: Neuer Vertriebspartner" [Videoton: New Sales Partner], COMPUTERWOCHE, Munich, No 17, 23 April 1982, p 53.

52. "Herzliche Treffen Erich Honeckers mit ungarischen Arbeitern und Bauem" [Friendly Meeting of Erich Honecker with Hungarian Workers and Builders], NEUES DEUTSCHLAND, Berlin (East), 4 June 1982, p 1.

53. "Die Werktaetigen von Videoton and Robotron in guter Partnerschaft," NEUES DEUTSCHLAND, op. cit., p 3.

54. "Friendly Meeting of Erich Honecker," op. cit., p 1.

55. Problems with the product information at the fairs have been discussed elsewhere. See, for example, John Kavanagh's reports from Leipzig. "Troubled 1050 Left out of Russian Display," COMPUTER WEEKLY INTERNATIONAL, 15 April 1976, p 21. It is assumed that this type of product information is promulgated only at fairs visited by technicians from the West in order to prevent an accurate impression of the real development status.

56. J. A. Fedotov: "Die Halbleiterelektronik in the UdSSR," op. cit., p 620.

57. Eberhard Kuehn and Horst Schmied give a detailed overview of Soviet circuit production in their "Handbuch Integrierte Schaltkreise" [Handbook of integrated circuits], Berlin (East), first edition, 1978, pp 326-328, 345, and 349-353, and "Analog Circuits Table of the USSR and Foreign Firms," ELORG, Moscow, 1978, p 62 and 63, and "Mikroprocessory," No 42, of the series on "Elementy Radioelektronnoi Apparatury" (in Russian), Moscow, 1981.

58. "UdSSR bereitet Zielprogramme fuer den Einsatz von Mikrorechnern vor" [USSR Prepares Target Programs for Use in Microcomputers], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 1, 1981, p 2.

59. Ibid.

60. "UdSSR bereitet," op. cit., p 2.

61. Regarding the activity of this foreign trade firm, see the discussion of J. Kislenko, "Five Years for ELORG," Aussenhandel UdSSR, Zeitschrift des Ministeriums fuer Aussenhandel der UdSSR, Moscow, No 1, 1976, pp 23-26.

62. See also the references in Press Information, Leipzig Spring Fair 1982, from 14 to 20 March 1982, Laenderbericht UdSSR, and "Leipziger Fruhjahrsmesse 1982: Leistungsfahige," op. cit., p 22, and "Leipziger Fruhjahrsmesse 1982," op. cit., p 360.

63. CAMAC means computer application for measurement and control and interface is an intersection or a level and sequence-normed junction between two pieces of equipment.

64. Regarding the ESER products of the USSR, see also Gerhard Merkel, "Entwicklungsrichtungen der elektronischen Rechentechnik" [Development Trends in Computer Engineering], DIE WIRTSCHAFT, Berlin (East), 18 April 1978, and Klaus Krakat, "Entwicklungstatbestande und...Part 1," FS-ANALYSEN, No 7, 1978, pp 16 ff, 28 ff and 32 ff, and fair information (1981) of the Soviet foreign trade company Electronorgtechnica.

65. Regarding Soviet products of the small computer type, see "Prozessrechnerkomplex CM-3" [The CM-3 Process Computer Complex, RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, 1978, pp 28-30; Gerhard Merkel, "Neue Geratesysteme des ESER und SKR" [New Equipment Systems of the ESER and SKR], RECHENTECHNIK/DATENVERARBEITUNG, No 2, 1979, and No 5, 1979, pp 5-9.

66. In addition, the designation "SM" is found in GDR literature, instead of the Soviet "CM."

67. The numbers of these systems being produced today cannot be determined from the available literature. Likewise, there are no indications about the technical capabilities of the individual computer system.
Previously it was extremely difficult to obtain accurate figures on computer production or on computer stocks in the USSR. Whereas countries like Romania or Hungary published some data in this regard, the Soviet Union had preferred to remain silent.

68. See also "Sowjetunion kuendigt mit ELBRUS neue Rechnergeneration an" [Soviet Union Announces the New ELBRUS Computer Generation], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 5, 1978, p 2.

69. For instance, R. Koehler, "Elektronische Datenverarbeitung in Osteuropa. Teil 1: Computerproduktion" [EDP in East Europe. Part 1: Computer production], ELEKRONISCHE DATENVERARBEITUNG, No 7, 1970, p 308.

70. "Diebold study: The Market for ADP Systems in [illegible], Frankfurt a.M., 1969, part 2, p 9 (unpublished).

71. See also Klaus Krakat; "Technologie verbessert--Rechnerbestand gering" [Technology Improved--Computer Stocks Low], COMPUTERWOCHE, Munich, No 33, 11 August 1978, p 12.

72. A Dorodnizyn, "Volkswirtschaft und Rechentechnik" [State Economy and Computer Engineering], PRAVDA, Moscow, 24 February 1966, translation printed in PdSU, Berlin (East), No 34, 23 March 1966, p 10.

73. See T. Degtjareva, "Die Wichtigsten Entwicklungsetappen der Sowjetischen Elektronischen Rechentechnik" [The Most Important Development Stages of Soviet Electronic Computers], NEUE TECHNIK IM BUERO, Berlin (East), No 5, 1977, p 129.

74. Small electronic calculators.

75. T. Degtjareva, op. cit., p 129.

76. Fast-acting electronic calculators.

77. Ibid.

78. See also the discussion in research report 1972 in the project of the German Research Alliance "Einflussfaktoren im Wachstumprozess der UdSSR unter den ockonomischen und gesellschaftlichen Bedungungen der sowjetischen Industriegesellschaft" [Factors Affecting the Growth of the USSR in the Economic and Social Conditions of Soviet Industry]. "Die Verbreitung neuer Technologien in der UdSSR, Fallstudie I: Elektronische Datenverarbeitung" [The Dissemination of New Technologies in the USSR, Case Study I: EDP], Osteuropa-Institut, Munich 1972, pp 148 and

79. Regarding Soviet computer developments, see A. Modin, "Ockonomisch mathematische Methoden, elektronische Rechentechnik und Steigerung der Effektivitaet der gesellschaftlichen Produktion" [Economic-mathematic Methods, Electronic Computer Engineering and Increasing the Effectiveness of Socialistic Production], SOWJETWISSENSCHAFT, GESELLSCHAFTSWISSENSCHAFTLICHE BEITRAGE, Berlin (East), No 7, 1972, pp 709ff; J. Slama, P. Sokolovski and H. Vogel, "Technologische Luecke zwischen West and Ost, Fallstudie Computer," OSTEUROPA WIRTSCHAFT, Stuttgart, No 2, 1974, pp 120-142, and Forschungsbericht 1972 zum Projekt der Deutschen Forschungsgemainschaft, "Einflussfaktoren..." Osteuropa-Institut, Munich, 1982, pp 117-151.

80. Regarding the first of the third-generation computers in the GDR, see Klaus Krakat, "Der Weg zur dritten Generation. Die EDV-Entwicklung in der DDR bis zum Beginn der siebziger Jahre: [The Route to the Third Generation. EDP Development in the GDR to the Beginning of the 1970s], FA ANALYSEN, No 7, 1976.

81. See A. Jefimov, "Vervollkommnung der Plaene durch Einfuehrung der Rechentechnik" [Plan-perfection by Introduction of Computers], ISVESTIA, Moscow, 7 September 1963, translation printed in PdSU, Berlin (East), No 122, 1963, pp 2669 and 2673.

82. W. Pugatshov; "Optimale Planung durch ein staatliches Netz von Rechenzentren" [Optimum Planning Through a State Network of Computer Centers], VOPROSSY EKONOMIKI, Moscow, No 7, 1964, translation printed in PdSU, Berlin (East), No 19, 15 February 1965, p 9.

83. Ibid.

84. See, for example, G. Andrianov and P. Buchatsharski, "Mathematische Methoden und elektronische Rechenmaschinen bei der Planung im Maschinenbau" [Mathematic Methods and Computers in Planning in the Machine-tool Industry], VOPROSSY EKONOMIKI, Moscow, No 6, 1963, translation printed in PdSU, Berlin (East), No 129, 6 November 1963, pp 2822-2826.

85. See in addition J. Tischer and W. Ziegler, "Dritte wissenschaftliche Konferenz zu Fragen der Anwendung elektronischer Rechenmaschinen fuer die Produktionlenkung," PdSU, Berlin (East), No 55, 14 May 1965, pp 11-17.

86. See also the discussion in a special reprint from the MESSE-KURIER (fairs in Leningrad) of Glahe International GmbH and Company. Regarding computer use in non-military spheres, see "Nichtmilitaerischer Bereich zenh Jahre hinter USA: Sowjetischer Peripheriemangal schraenkt Rechnereinsatz ein" [Non-military Sphere 10 Years Behind the USA: Soviet Periphery Deficiencies Restrict Use of Computers], COMPUTERWOCHE, Munich, No 46, 14 November 1980, p 48, and Ruth Heuertz: "The Computer and Soviet Society," OSTEUROPA-WIRTSCHAFT, Stuttgart, No 3, 1980, pp 215-224. For the status of text processing in the USSR in 1977, see "Systematochnika 77 pflegt Distributed Processing: Moskau entdeckt die Textverarbeitung" [Systemotechnika 77 Is Pushing Distributed Processing: Moscow Discovers Text Processing], COMPUTERWOCHE, Munich, No 51/52, 16 December 1977, p 20.

87. See also L. Katshalin; "Probleme der wissenschaftlichen Organisation der Leitungstaetigkeit" [Problems of Scientific Organization of Management], KOMUNIST, No 15, 1964, translated in PdSU, Berlin (East, No 137, 30 November 1964, pp 3025-3028; A. Dorodnizyn, "Volkswirtschaft und Rechentechnik," PRAVDA Moscow, 24 February, translated in PdSU, Berlin (East), No 34, especially p 10; A. Dorodnizyn, "Rechentechnik will mit Verstand eingesetzt werden" [Computers to be Used with Understanding], NEDELIA, No 28, 1966, translated in PdSU, Berlin (East), No 113, 30 September 1966, pp 14 and 15; "Orgtechnik wind beschleunigt entwickelt," EKONOMITSHESKAIA GASETA, No 29, 1966, translated in PdSU Berlin (East), No 139, 5 December 1966, pp 7 and 8; A. Aganbegian; "Zum System der oekonomisch-mathematischen Modelle fuer die Perspektivplanung" [The System of Economic-mathematic Models for Perspective Planning], EINHEIT, ZEITSCHRIFT FUR THEORIE UND PRAXIS DES WISSENSCHAFTLICHEN SOZIALISMUS, Berlin (East), No 6, 1969, especially p 655; regarding the obstacles to the introduction of EDP, see also the discussions in PRAVDA, Moscow, 5 January 1971, p 2, and in SOZIALISTITSHESKAIA INDUSTRIA, 10 August 1972, p 3.

88. "Einseiter West-Ost-Technologie-Transfer zum Vorteil fuer den Comecon" [One-sided West-East Technology Transfer to the Advantage of Comecon], FS-ANALYSEN, No 4, 1981.

89. Business information from the Dusseldorf Fair Company, Ltd., NOVEA, for the SYSTEMOTECHNIKA '80 in Leningrad of 25 November 1980, pp 1, 3 and 4.

90. See "Duetscher Zoll beschlagnahmte amerikanische Computer-Lieferung" [German Customs Approves American Computer Delivery] DER TAGESSPIEGEL, Berlin (West), 15 July 1982, p 2: 1 television program of 15 July 1982, 2230 hours, in the news transmission "Tagesthemen" and "Zoll beschlagnahmt in Frankfurt und Munchen DEC Rechner: 'Exodus' beendet US Computerexport" [Customs Approves in Frankfurt and Munich the DEC Computer: Exodus Ends US Computer Export], COMPUTERWOCHE, Munich, No 30, 23 July 1982, pp 1, 2.

91. W. Pugatshov; "Optimale Planung durch ein staatliches Netz" op. cit., No 7, 1964, PdSU, Berlin (East), No 19, 15 February 1965, p 9.

92. See also J. Tischer and W. Ziegler; "Dritte wissenschaftliche Konferenz zu Fragen der Anwendung elektronischer Rechenmaschinen fuer die produktionslenkung," op. cit., pp 11ff.

93. Regarding the development phases for automated management systems, see Sabine Ganzert, Brigitte Stenzel and Cornelia Dumcke, "Zum Inhalt und zur Projektion von ASU in the UdSSR. Ein Literaturbericht" [The Content and Projection of ASU in the USSR. A Literature Report], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 2, 1976, p 70.

94. Abbreviated in the GDR as "ALS" or "ASL (automated system of management)." The Soviet abbreviation is "ASU = automatisirovannaia sistema upravlenia."

95. See L. G. Petrova; "Schaffung industriezweiggebundener Informationsysteme" [Creation of Industry-related Information Systems], MECHANISAZIA I AVTOMATISAZIA, Proisvodstvo No 6, 1976, translated in PdSU, Berlin (East), No 32, 18 August 1966, pp 14-16.

96. See S. Sergeiev "Automatisierte Leitungssysteme" [Automated Management Systems], EKONOMITSHESKAIA GASETA, No 43, 1966, translated in PdSU, Berlin (East), No 134, 23 November 1966, pp 9-10.

97. On the System Freser, see also "Wissenschaftliche Betriebsfuehrung im Werk 'Freser'" NEUES DEUTSCHLAND, Berlin (East), 22 February 1969; "Automatisierte Steuerung der Produktion" DIE WIRTSCHAFT, Berlin, (East), No 2, 9 January 1969, pp 16 and 17; "Das Werk 'Freser,'" DIE WIRTSCHAFT, Berlin (East), No 19, 8 May 1969, pp 11-13.

98. See also "Ein Betrieb der Zukunft" [A Factory of the Future], DIE WIRTSCHAFT, Berlin (East), No 20, 15 May 1969, pp 19 and 20.

99. See "Automatisiertes Leitungssystem fuer Geraetebau" [Automated Management System for Equipment Building], NEUES DEUTSCHLAND, Berlin (East), 8 August 1970.

100. See "System von Stscholino beispielgebend fuer andere Betriebe" [The Stsholino System as an Example for Other Factories], EKONOMITSHESKAIA GASETA, No 47, 1971, translated in PdSU, Berlin (East), No 149, 1971, pp 11 and 12.

101. See "Zement-1--das erste automatisierte Leitungssystem der Bauindustrie" [Zement-1--the First Automated Management System for the Construction Industry], PRAVDA, Moscow, 13 September 1971, translated in PdSU, Berlin (East), No 139, 1971, pp 12 and 13.

102. See Sabine Ganzert, Brigitte Stenzel and Cornelia Dumcke, op. cit., p 70.

103. Materials of the 26th Party Congress of the CPSU, Moscow, Politisdat, 1972, p 298, quoted in J. Salomon, "Die Gestaltung eines automatisierten Systems der Normativinformationen in der UdSSR" [The Structure of an Automated System of Normative Information in the USSR], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 2, 1975, p 5.

104. "Automatisierte leitungssysteme, Teil 1, Sowjetische Erfahrungen bei der Ausarbeitung und Anwendung automatisierter Systeme fuer die Leitung und Produktion" [Automated Management Systems, Part 1. Soviet Experiences in the Preparation and Application of Automated Systems for Management and Production]. BEILAGE ZUR PDSU, Berlin (East), No 78, 5 July 1971, and "Part 2," PdSU, Berlin (East), No 84, 17 July 1971.

105. As per Sabine Ganzert, Brigitte Stenzel and Cornelia Dumcke, op. cit., p 70.

106. Quoted in Angelika Conrad and Kurt Sank, "Neue Aspekte der Entwicklung von ASU" [New Aspects of the Development of ASU], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 2, 1976, p 10.

107. N. Moissejev, "Der Einsatz von EDV-Anlagen--Perspektiven und Illusionen" [The Use of EDP Systems, Perspectives and Illusions] SOWJETWISSENSCHAFT, GESELLSCHAFTSWISSENSCHAFTLICHE BEITRAEGE, Berlin (East), No 8, 1975, p 856.

108. In addition, see Klaus Krakat, "Computerproduktion und Computereinsatz in der GDR," FS-ANALYSEN No 3, 1977, pp 49-53.

109. See especially "Vorschau auf die Moskauer ESER II/SKR Ausstellung: Im Mittelpunkt die Systemloesung" [View of the Moscow ESER II/SKR Exhibit Emphasizing the System Solution], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 4, 1979, pp 5-7, and Dieter Buttgereit and Herbert Adam, "Geraetetechnik und Systemloesungen der sozialistischen Laender" [Equipment Engineering and System Solutions in Socialist Countries], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 5, 1979, pp 5-9.

110. See "Vorschau auf die Moskauer ESER II/SKR Ausstellung," op. cit., pp 5 ff; Dieter Buttgereit and Herbert Adam, op. cit., pp 5 ff; Wolfgang Suesspeck, "Die Entwicklung von automatisierten Systemen fuer die Leitung (ASU) im Verkehrswesen der UdSSR (Teil 1), DDR VERKEHR, Berlin (East), No 11, 1979, pp 383-386 and Part 2," DDR VERKEHR, Berlin (East), No 12, 1979, pp 413-417, and RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, p 78.

111. From the pertinent literature one cannot tell whether these two systems are different or the same.

112. See especially the additional discussion by Dieter Buttgereit and Herbert Adam, op. cit., pp 5ff.

113. See also W. Pugatshow; "Optimale Planung," op. cit., p 9.

114. W. Besrukov and G. Venikov, "Probleme bei der Einfuehrung der Rechentechnik in die Volkswirtschaft" [Problems in the Introduction of Computers to the Economy], MASCHINOSTROITEL, No 8, 1965, translated in PdSU, Berlin (East), No 84, 26 July 1965, p 9.

115. See W. Besrukov and G. Wenikov, op. cit., p 10.

116. Ibid., p 9.

117. Ibid.

118. See also the discussion in "Staatliches Netz von Rechenzentren in der Sowjetunion" [State Network of Computer Centers in the Soviet Union], STATISTISCHE PRAXIS, Berlin (East), No 6, 1966, pp 227-228.

119. See PRAVDA, Moscow, 27 August 1974, p 2, and EKONIMICESKAIA GAZETA No 2, January 1974, p 2.

120. See I. M. Korostelin, "Experiment in der UdSSR: Territoriale Rechenzentren kollektiver Nutzung" [Experiment in the USSR: Territorial Computer Centers for Collective Use], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, 1979, pp 8-9.

121. Ibid., p 8.

122. See "EDV unterstuetzt Leitung im Leningrader Gebiet" [EDP Supports Management in the Leningrad District], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 12, 1978, p 2.

123. I. M. Korostelin, op. cit., p 8.

124. See also the references in HOSPODARSKE NOVINY, No 21, 23 May 1980, p 1.

125. See also the brief information "Importbedarf der CSSR gering" [CSSR's Import Needs Are Low], DIE COMPUTER ZEITUNG, Munich, No 10, 21 April 1982, p 4, and as a supplement to this, the pertinent references in HOSPODARSKE NOVINY, No 21, 23 May 1980, pp 1-5.

126. For example, "CSSR entwickelt Mikroelektronik" [CSSR Is Developing Microelectronics], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 5, 1981, p 2. See also the references in SVET HOSPODARSTVI No 45, 11 April 1980, p 1.

127 See also a report in DIE WIRTSCHACT, Berlin (East), No 6, 1981, p 28.

128. See also the additional discussion in RADIO FERNSEHEN ELEKTRONIK, Berlin (East), No 6, 1980, p 345, and J. Vasenda, "Integrierte Schaltkreise von TESLA" [TESLA Integrated Circults], NACHRICHTENTECHNIK-ELEKTRONIK, Berlin (East), No 5, 1979, pp 209-212.

129. See also the pertinent references in "Leipziger Fruhjahrsmesse 1982" [Leipzig Spring Fair 1982], RADIO FERNSEHEN ELEKTRONIK, Berlin (East), No 6, 1982, pp 346 and 347.

130. See "Rachentechnik-Kombinat ZAVT (CSSR) mit grossem Aufgabenspektrum" [ZAVT Computer Combine With Large Range of Tasks], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 7, 1979, p 2, and in addition "Neues Kombinat Fuer Rechentechnik in der CSSR" [New Combine for Computer Engineering in the CSSR], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 3, 1979, p 2. (The abbreviation ZAVT is identical to ZVT.)

131. "Rechentechnik-Kombinat ZAVT (CSSR) mit grossem Aufgabenspektrum," op. cit., p 2.

132. Ibid.

133. See also the KOVO exhibit (Hannover Fair 1981 and 1982).

134. See I. Sujan and J. Sepp: "Wissenvorlauf fuer die Rechentechnik der CSSR. Forschungszentrum Bratislava" [The Bratislava Research Center: A Scientific Advance for CSSR Computer Engineering], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, 1981, p 32.

135. See also "Leipziger Fruehjahrsmesse 1982," op. cit., pp 346-347 and 361.

136. Regarding the circuit production, see also Jaromir Jurecka, "Tschechoslowakische IS fuer Mikrorechnersysteme" [Czech IC for Microcomputer Systems], RADIO FERNSEHEN ELEKTRONIK, Berlin (East), No 2, 1982, pp 415-418.

137. Detailed references are found in the special product information bookets of KOVO.

138. MOS means metal oxide semiconductor, or semiconductor engineering which permits very high circuit input resistances.

139. See also especially Eberhard Kuhn, Horst Schmied: Hanbuch Integrierte Schaltkreise, op. cit., pp 328 and 329.

140. See also Klaus Krakat, "Elektronische Datenverarbeitung in Bulgarien unter Beruecksichtigung ihrer Bedeutung fuer die DDR," [EDP in Bulgaria Under Consideration of Its Importance for the GDR[, FS-ANALYSEN, No 6, 1979, p 22.

141. See Horst Schmied, "Elektronische Bauelemente der VR Bulgaria" [Electronic Components of Bulgaria], RADIO FERNSEHEN ELEKTRONIK, Berlin (East), No 4, 1979, pp 251-252.

142. See also "Neues Planjahrfunft bringt Qualitatussprung fur EDV Bulgariens" [New 5-Year Plan Provides a Jump in Quality for Bulgaria's EDP], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 6, 1980, p 1.

143. See also Klaus Krakat, "Elektronische Daten verarbeitung in Bulgarien unter Beruecksichtigung ihrer Bedeutung fuer die DDR," op. cit., pp 18 and 19.

144. K. Bojanov and Ch. Karadshov, "Entwicklungsstand der elektronischen Rechentechnik in der VR Bulgarien" [Computer Development Status in Bulgaria], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 8, 1980, p 5; regarding the production facilities subordinate to the State Economic Combine (SWV) ISOT, see Klaus Krakat, "Elektronische Datenverarbeitung," op. cit., pp 21 and 22.

145. See especially the GDR journal RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 6, 1980, with several entries on EDP in Bulgaria and also Klaus Krakat, "Elektronische Datenverarbeitung in Bulgarien," op. cit., p 23, and "Die EDV Systeme der RGW Laender, Teil 5, Bulgarien: EDV Industrie mit exportintensiver Produktion" [CEMA EDP Systems, part 5: Bulgaria. EDP Industry with Export Bias], COMPUTERWOCHE, Munich, No 45, 3 November 1979, p 10.

146. See also K. Bojanov and Ch. Karadshov, "Entwicklungsstand der elektronischen Rechentechnik," op. cit., pp 5 and 6.

147. See also K. Bojanov and Ch. Karadshov, op. cit., p 8.

148. As per "Elektronik auf der Plowdiwer Mess" [Electronics at the Plovdive Fair], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 12, 1980, p 2.

149. See also "Leipziger Fruehjahrsmesse 1982: Leistungsfaehige Rechentechnik," op. cit., p 22; Press-Informationen, Leipziger Fruehjahrsmesse 1982 from 14 to 20 March, Laenderbericht Bulgarien and Leipziger Fruehjahrsmesse 1982, op. cit., pp 361 and 362.

150. See also special Fair Information Sheets by ISOTIMPEX.

151. See also Maria Haendcke-Hoppe, "Spezifische Probleme der Aussenwirtschaft" [Specific Problems of Foreign Trade], Wirtschaftsstrategie der DDR fur die achtziger Jahre, 7. Symposion der Forschungsstelle, Referate am 19 November 1981, FS-ANALYSEN, No 8, 1981, p 43.

152. See also as a supplement, Klaus Krakat, "Die EDV-Systeme der RGW-Lander-Teil 1--Polen: Polens EDV-Industrie baut auf westliches Know-how" [EDP Systems in CEMA Countries--Part 1--Poland: Poland's EDP Industry Builds on Western Know-how], COMPUTERWOCHE, Munich, No 37, 8 September 1978, p 10.

153. See also specific information sheets of DEPOLMA.

154. These computers were produced after the mid-1970s.

155. See also the statements in the POLNISCHE WIRTSCHAFTANZEIGER, ed. Polish Foreign Trade Chamber, Warsaw, 16-31 October, No 20, 1980, p 7.

156. Regarding the circuit types produced in Poland, see also Eberhard Kuehn and Horst Schmied, "Handbuch Integrierte Schaltkreise," op. cit., pp 346-351, 356 and 357.

157. Regarding the individual technical data, see the discussion in the product description of the Institute for Industrial Automation.

158. See "Leipziger Fruehjahrsmesse 1982: Leistungsfaehige Rechentechnik," op. cit., p 23, and "Leipziger Fruehjahrsmesse 1982," op. cit., p 347.

159. For example, the brief information "Polen liefert Mikros an die UdSSR" [Poland Delivers Micros to the USSR], POLNISCHE WIRTSCHAFTANZEIGER, No 20, 16-31 October 1980, p 7.

160. Ibid.

161. See also "Minicomputer fuer die Sowjetunion" [Minicomputers for the Soviet Union], POLNISCHE WIRTSCHAFTSANZEIGER, No 20 16-31 October, p 7.

162. See also the discussion in REVISTA ECONOMICA, Buckarest, No 31, 1 August 1975, pp 13-14.

163. See also Klaus Krakat, "Entwicklungstatbestaende und entwicklungsrichtungen der RGW Laendern," op. cit., p 35.

164. See also Klaus Krakat, "Die EDV-Systeme der RGW Laender, Teil 4: Rumania. Rumania ohne ESER Verpflichtungen" [The EDP Systems of the CEMA countries, Part 4: Romania. Romania Has No ESER Obligations], COMPUTERWOCHE, Munich, No 44, 27 October 1978, p 19.

165. As in "Mehr DV Eigenentwicklung" [More Domestic ADP Development], COMPUTERWOCHE, Munich, No 47, 23 November 1979, p 32.

166. Regarding current economic situation in Romania see especially the discussion by Jochen Bethgenhagen, "Zahlungsbilanzkrise und Wachstumsabschwachung" [Balance of Payments Crisis and Decline in Growth], DIW BERLIN, Wochenbericht 23/1982, [as printed] pp 300-307.

167. See also the discussion in VIATA ECONOMICA No 2, 11 January 1974, p 9.

168. See also references in Presse Informationen, Leipziger Fruehjahrsmesse 1982... Laenderbericht Rumanien, "Leipziger Fruehjahrsmesse 1982: Leistungsfaehige Rechentechnik..." op. cit., p 23, and special fair information sheets of the foreign trade company ELECTRONUM.

169. See also J. Bai, "Kuba entwickelt die Produktion von Kleinrechnern" [Cuba Develops Production of Small Computers], ISVESTIA, Moscow, 5 February 1982, translated in PdSU, March 2 edition, No 6, 1982, p 54.

170. See Otmar Steger, "ESER macht Vorteile sozialistischer ockonomischer Integration deutlich" [ESER Makes Clear the Advantages of Socialist Integration], BERLINER ZEITUNG, Berlin (East), 5 May 1973.

171. J. Bai, op. cit., p 54.

172. Regarding the small computer CID 201b, see the brief information in RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 1, 1977, p 4, and No 3, 1977, p 3.

173. See "105 Rechner in verschiedenen Bereichen der Kubanischen Volkswirtschaft" [105 Computers in Various Areas of the Cuban Economy], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 3, 1977, p 3.

174. "Erstes Bezirksrechenzentrum in Kuba eroeffnet" [First District Computer Center Opened in Cuba], RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 9, 1978, p 2.

175. See Dieter Buttgereit and Herbert Adam, op. cit., pp 5, 6 and 9, and as a supplement, "Vorschau auf die ESER II/SKR Ausstellung," op. cit., p 5.

176. Dieter Buttegreit and Herbert Adam, op. cit., p 6.

177. Sm is the abbreviation used in the GDR for "System der Minimaschinen," CM is the Soviet abbreviation.

178. See also the brief information in RECHENTECHNIK/DATENVERARBEITUNG, Berlin (East), No 6, 1982, p 2.

179. Regarding the acceleration of economic growth via newest technologies, see Klaus Krakat; "Neuere Tatbestaende der Mikroelektronik" : Wirtschaftswachstum in Theorie und Praxis des DDR-Systems, 7. Symposium der Forschungsstelle, Referate am 20 November 1981, FS-ANALYSEN No 9, 1981, pp 81ff, and in the same journal, "Mikroelektronik als Zauber formel zur Realisierung der geplanten Wirtschaftsentwicklung" [Microelectronics as a Magic Formula for Realizing Planned Economic Development] Ausgewaehlte wirtschafts- und sozialpolitische Aspekte des X. Parteitages der SED, FS-ANALYSEN, No 3, 1981, pp 40ff.

180. See "XXXVI. RGW-Tagung in Budapest eroffnet. Bruderlaender beraten neue Schritte der Zusammenarbiet [36th CEMA Convention Opened in Budapest. Brother Countries Counsel New Cooperative Steps], NEUES DEUTSCHLAND, Berlin (East), 9 June 1982, pp 1 and 2, and "RGW Ratstagung eroerterte neue gemeinsame Vorhaben" [CEMA Advisory Conference Clarified New Joint Projects], NEUES DEUTSCHLAND, Berlin (East), 10 June 1982, pp 1, 3 and 6.

181. "XXXVI. RGW-Tagung in Budapest beendet. Bedeutsame Abkommen zur Intensivierung vereinbart" [36th CEMA Convention in Budapest Ends. Important Agreement on Intensification Is Concluded], NEUES DEUTSCHLAND, Berlin (East), 11 June 1982, p 1, and the "communique" of this CEMA convention on p 6, Ibid. See also the references in "XXXVI. RGW Tagung in Budapest eroeffnet. Bruderlaender beraten neue Schritte der Zusammenarbeit," op. cit., p 2.

182. See Klaus Krakat, "Neuere Tatbestaende der Mikroelektronik," op. cit., p 111; "DDR Computer Hersteller sucht Partner fuer OEM und Buerocomputer: Robotron Besteht nicht auf gemainsamen Vertriebsweg" [GDR Computer Producer Seeks Partners for OEM and Office Computers: Robotron Abandons Common Sales Path], COMPUTERWOCHE, Munich, No 15, 10 April 1981, p 17; "Ungarischer Elektrokonzern mit Hannover zufrieden: Vedeoton nach Munchen" [Hungarian Electrical Company Satiisfied with Hannover: Videoton to Munich], COMPUTERWOCHE, Munich, No 19, 9 May 1980, p 48; "Videoton. Mit den Ungarn let's go South!" COMPUTER MAGAZIN, No 2, 1982, pp 20-21.

183. "Direktive des X. Parteitages der SED zum 5-jahrplan fuer die Entwicklung der Volkswirtschaft der DDR in the Jahren 1981 bis 1985" [Directives of the 10th Party Congress of the SED on the 5-Year Plan for the Development of the Economy of the GDR from 1981 to 1985], NEUES DEUTSCHLAND, Berlin (East), 18/19 April 1981, pp 3 and 5.

184. Klaus Krakat, "Mikroelektronik als Zauberformel," op. cit., p 45.

185. See "Videoton: Fluege reserviert" [Videoton: Wings Reserved], COMPUTERWOCHE, Munich, No 13, 27 March 1981, p 44.

186. "Die Werktaetigen von Videoton und Robotron in guter Partnerschaft," op. cit., p 3.

187. See also Doris Cornelsen, "DDR Wirtschaftssystem: Kontrollmechanismen erneut verschaerft" [GDR Economic System: Control Measures Reintensified], DIW BERLIN, WOCHENBERICHT, No 21, 27 May 1982, p 269.

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EC 1045 COMPUTER DESCRIBED; DELIVERY TO CSSR ANNOUNCED

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 4, 82
pp 391-399

[Article by Eng Karel Hornof, Kancelarske k.u.o. [Office Machines Special Concern], Prague: "The EC 1045 Electronic Digital Computer"]

[Text] 1. Introduction

The prospects of deliveries of data processing equipment during the Seventh 5-Year Plan make it apparent that next to the domestically produced EC 1025 computer, the Soviet EC 1045 will be the most extensively used model. Deliveries of the first EC 1045's to Czechoslovakia will begin at the end of 1982.

Most of the production and configuration of these computers is taking place at the Kazan Electronic Computers Plant, in which this model continues a tradition of more than 10 years' standing involving two computers well known here: the EC 1030, delivered to us between 1972 and 1976, and the EC 1033, delivered between 1977 and 1982.

The EC 1045 includes several peripheral devices produced in other plants in the Soviet Union and other countries. An example of Czechoslovak participation is the use of contactless keyboards, electric typewriters and matrix printers produced by Zbrojovka Brno.

2. General Description of the EC 1045

The EC 1045 is a general-purpose digital computer of medium power intended for a wide range of scientific-technical, economic and information-processing tasks in local and teleprocessing systems, including real-time systems.

Compared with third-generation computers, the EC 1045 offers the user several advantages:

--virtual memory, making up to 16 Mbyte of addressable memory available to the users;

--an expanded instruction set (183 instructions);

--the introduction of fast byte-multiplex and block-multiplex channels which make it possible to connect a wide range of peripherals to the computer, with a total capacity of 5 Mbyte/sec;

--flexibility, making it possible to create various configurations according to user needs;

--an expanded control mode, allowing the use of new types of hardware;

--additional time-measuring and recording features (processor timer, comparator, time-of-day clock, device for limiting processor idle time);

--devices for recording program events, a monitor, restart interrupt;

--byte-oriented operands (foremost instructions, the limitation that operands in internal memory must begin at word boundaries has been removed);

--hard-wired microprogrammed instruction repeat and expanded situation records in the case of an error.

3. Some Characteristics of the EC 1045 Hardware

Control Store

Processor operation is controlled by a combination hardwired microprogram method. Functions for which high speed is required, such as internal store access, instruction fetch and the most time-critical channel functions, are hardwired.

The capacity of the control store, which contains the processor and channel microcommands, is 8K 72-bit words. Of these, 7K words are read-only memory hardwired in integrated circuits which are programmed during production of the computer. The remaining 1K words are writable storage in which is entered diagnostic microprograms and certain console microprograms. The latter are entered from the ML 45 special cassette tape store.

Memory Control Unit

The functions of the memory control unit, which organizes requests for access to internal memory, are hardwired. The memory control unit performs the following functions:

--exchange of information with external storage through an 8 Kbyte fast buffer memory and a buffer memory for instruction fetch with a capacity of 32 72-bit words;

--access to internal storage with an information flow width of 4 words (16 bytes), with memory protection and checking by means of a modified Hamming single-bit error-correcting, double-bit error-detecting (SEC-DED) code;

--during virtual memory operations, dynamic translation of logical addresses to real addresses;

--an interface to the passive memory of the channels, located in the last 16 Kbyte of internal storage;

Dynamic address translation is speeded up by the following features:

--a preceding-segment index register which carries out translation only page-by-page if the segment index is unchanged;

--a buffer store for fast translation, with a capacity of 128 24-bit addresses, which holds the previously-translated addresses: when consecutive addresses correspond, this eliminates an internal memory access;

The semiconductor buffer memory, which consists of 2 blocks, each containing 512 72-bit words, increases the operating speed of the processor. Read and write operations from buffer memory are carried out under the control of the index store, which stores the addresses of the data currently in the buffer store.

Accelerator

The accelerator is a special unit intended to speed up the operations of multiplication, conversion between number systems, conversion to staged and zoned operand types, and byte shift and transfer (MVC, MVCL). The accelerator is controlled by microprograms of a lower level called "picoprograms," which are stored in a picomemory of 512 48-bit words. Accelerator results, with a maximum length of four words, are transferred to the memory control unit.

Processor Local Storage

The processor local store has a capacity of 64 words and stores the contents of the general registers and floating-point registers, as well as intermediate results, some of the program status word (PSW), control information including information for recording faults and storing functions, and the internal timer values.

Input-Output Channels

Input and output are carried out in the EC 1045 by means of byte-multiplex and block-multiplex channels. The channels are under combined hardwired microprogram control. Information exchange between the input-output (1/0) channels and internal storage, as well as processing of control information. is carried out by the processor under microprogram control.

The EC 1045 may include up to two byte-multiplex and five block-multiplex channels.

The byte-multiplex channel may contain up to 256 subchannels and may operate in the multiplex mode with a transmission speed up to 40 Kbyte/sec or in the continuous mode with a speed of 120 Mbyte/sec.

The transmission speed of the block-multiplex channels ranges from 0.5 to 1.5 Mbyte/sec.

As many as 10 controllers can be connected to each channel at a distance up to 60 meters. The number of devices connected to the byte-multiplex channel can be increased to 19 by using a special device, the logical retranslator.

The I/O channels make it possible to connect the full range of peripherals, including telecommunications equipment, through the standard interface.

Peripherals

The EC 1045 system includes peripherals familiar from the EC 1033 configuration. A list of these is presented on the section "Configuration of the EC 1045." During 1983 and 1984 there will be innovations in the production of card punches (the EC 7010 will be replaced by the EC 7018) and the previously delivered EC 7032 line printer will be replaced by the EC 7037 chain printer. The EC 7920 display system is standard equipment in the EC 1045; only a local version will be included in the first deliveries to Czechoslovakia.

The EC 7920 display system consists of a set of hardware allowing input and output of alphanumeric data. The Soviet version of this system can be divided into the following two main types:

(a) a group local subsystem consisting of the EC 7922 control unit, connected to the standard channel of the computer; to this control unit can be connected up to 32 display workplaces (EC 7927) with keyboard or a matrix printer (EC 7934) at distances up to 1,200 meters;

(b) a group remote subsystem consisting of the EC 7921 controller, connected by modems and a data transmission multiplexer through telephone links of any length to the computer; the same types and numbers of workstations as in the case of the local subsystem can be connected to this controller, at distances up to 1,200 meters.

Power Supply for the Ec 1045

The power supply for the EC 1045 computer includes:

--a motor-generation which provides electrical isolation from the power grid and also functions as a stabilizer;

--a control card for remote starting and stopping of the motor-generator;

--distribution equipment carrying AC current for all equipment;

--power supplies for the internal store, matric processor and peripherals.

The secondary power supply consists of modified "Rjad 2" power supplies. If use of further peripherals increases total power construction above 45

KVA, an additional motor-generator, control card and distribution equipment must be added.

Matrix Processor

At the user's request, the EC 1045 can be equipped with an EC 2345 matrix processor. This is a special processor which operates with standard I/O instructions. The matrix processor is intended for powerful processing of sets of data in various fields of science and engineering. It is particularly useful in problems involving a large quantity if input data and many repetitions of a limited set of mathematical operations. The El 2345 matrix processor consists of the following components:

--an arithmetic unit;

--a control unit;

--a microprogram control unit;

--a control console;

--a power supply system.

The arithmetic unit performs arithmetic operations of the form z = y + ix with floating-point operands. The arithmetic unit is microprogram-controlled and data processing is sequential.

The control unit is intended for reception and processing of channel instructions from the center processor of the EC 1045, reading of control words and data from the main store, conversion of input data before they are fed to the arithmetic unit, recording of the channel status word and registration of information on correct or incorrect operations. This unit also operates under microprogram control. Data can be read and written while processing is under way in the arithmetic unit.

The microprogram control unit controls the operation of the control and arithmetic units. It receives microinstructions from control memory and forms microcommands and the address of the subsequent microcommand. The microprogram control unit has 2,048 44-bit words. The fetch time is 80 ns.

The control console is the basic device for operator interface with the matrix processor. In the stand-alone mode it allows checking and preventive maintenance.

The EC 2345 matrix processor uses its own system of checking and diagnostics. Much of the equipment operates under continuous hardware checking, which allows identification and rather accurate location of faults.

The matrix processor is powered by a 380/220 VAC motor-generator; the maximum power consumption is 2 KVA.

Under normal operating conditions the matrix processor has the following reliability characteristics:

--time to failure, minimum	1,000 hours
--availability, minimum	0.95
--average recovery time, maximum	0.5 hours.

The matric processor is capable of performing seven vector, matrix and special operations on data at high speed. These operations make up the basic set of algorithms in the solution of problems where mumerical methods are used.

In the EC 1045 system, the matrix processor is an effective means of processing data, particularly in the case of problems using matrix algebra, mathematical statistics, and numerical and matrix methods for solving differential equations and in all cases where fast processing of large sets of data is required. The set of control operation instructions for the processing of large sets of data includes the following vector and matrix arithmetic operations:

--element-by-element multiplication of vectors;

--element-by-element addition of vectors;

--multiplication of a vector by a scalar;

--square of a vector (element by element);

--addition of squares of vectors (element by element);

--scalar product of vectors

--partial multiplication of matrices;

--multiplication of complex vectors.

In addition, the following operations of displacement and transformation of data formats can be carried out:

--shifting of vectors with transformation of data format;

--shifting of vectors with transformation to fixed-point and special operations;

--short multiplication;

--decomposition of vectors;

--fast Fourier transform.

The EC 2345 matrix processor can receive data in one of the following formats: fixed-point data in complement code; fixed-point data in direct code; floating-point data.

The matrix processor software includes an access method, a set of technical service programs and a set of microdiagnostic programs.

4. Basic Technical Data for the EC 1045

Operation speed	
--scientific-technical calculations (Gibson III)	up to 870 operations/second
--statistical calculations (GPO-WU-II)	530,000 operations/second
Instruction system	general purpose, 183 instructions
Capacity of internal store	1-4 Mbyte
Channels	
byte-multiples	
number	2
transmission speed,	
continuous mode	160 Kbyte/sec
multiplex mode	40 Kbyte/sec
block-multiples	
number	up to 5
transmission speed, maximum	1.5 Mbyte/sec
Total capacity of channels	5 Mbyte/sec
Multiprogramming operation	
MFT [fixed task] and MVT[variable task] modes	up to 15 user programs simultaneously
SVS mode	unlimited number of programs
Compatibility	
hardware	all EC equipment
software	upward compatible with all EC computers
System capabilities	
two-processor system	
multicomputer system	
Operating mode	one to three shift with shut-off, or continuous

5. Diagnostics

The EC 1045 has an especially powerful diagnostic system. Automatic indication and location of malfunctions in the computer is carried out by a means of a special set of diagnostic microinstructions. Diagnostic tests can be used to check practically all circuits of the processor, channels, memory control unit, internal store and control console. On the average, malfunctions can be located to within 1 or 2 TEZ's (replaceable modules). The entire

diagnostic system is based on the bootstrap method and starts from a small nucleus consisting of the ML 45 cassette magnetic tape unit and a service adapter, which reads in the tests from the tape, accumulates data and writes it into control memory, controls the course of diagnostic operations and compares the results with a standard.

The microdiagnostics are carried out in two stages. In the first, the microdiagnostic tests are carried out in the start-stop mode and the individual microinstructions are run independently. In the second stage the microdiagnostic tests are run at the actual speed of the computer. Information on faults is displayed by indicator lights on the control panel. This display makes it possible to look up exhaustive information in the documentation, thus allowing location of the fault. The testing of all circuits by means of the microdiagnostics takes less than 15 minutes. The microtests can be cycled through, or specific assemblies can be tested selectively.

In addition, the EC 1045 has a built-in autonomous tested allowing location of faults on a malfunctioning TEZ.

Most of the processor circuits (about 95 percent) have continuous hardware checking with self-checking capabilities.

The automatic recovery system is realized in both hardwired microprogramming and software. The design for the recovery system sprang from the experience that most errors (about 75 percent) result from intermitten faults, after which serviceability is restored. The facilities for restoring operation of the EC 1045 allow the computation process to be continued or restarted when an intermittent fault occurs. This is carried out either by correcting single-bit errors in the internal store or by repetition, starting with the instruction in which the fault occurred. After successful repetition, normal operation continues, but the fault is registered for subsequent analysis. Otherwise the situation which leads to an error will be repeated up to eight times. If these repeated attempts are unsuccessful, the control circuits store the status of the computer and initiate an interrupt.

The built-in self-maintenanee functions also carry out testing by means of microdiagnostics and software when the voltage in the secondary circuit varies by ± 5 percent from the rated value. The voltage levels are switched automatically by a special ASKDE [automatic testing and diagnostic system] device. This device checks temperature conditions and input voltage levels and locates devices with power supply faults.

6. The VK-2P-45 and VK-2M-45 Multicomputer Complexes

Both of these complexes, based on the EC 1045 computer, demonstrate high reliability and productivity in the performance of user tasks.

The standard configuration can be based on either the EC 3206 ferrite memory (VK-2P-45, VK-2M-45) or the EC 3267 semiconductor memory (VK-2P-45.01, VK-2M-45.01). The total internal storage capacity of the standard configuration is 2 Mbyte, expandable to 8 Mbyte.

If necessary, the VK-2P-45.01 and VK-2M-45.01 computer complexes can be operated as two independent CC 1045 computers.

For comparison we present several characteristics of the EC 1045.01 computer and the VK-2P45.01 and VK-2M-45.01 complexes in the basic operating mode.

	EC 1045.01	VK-2P-45.01	VK-2M-45.01
Operation speed (Gibson III), 10^6 operations/sec	0.85	1.7	0.85
Average time to failure, hours	250	2,500	3,500
Average time between self-correctable faults, hours	25	25	--
Power consumption, kVA	25	50	60
Space required, m^2	120	135	250
Investment, relative units	1.0	1.5	2.2

Interprocessor communication is carried out through a special instruction, PROCESSOR SIGNAL.

In the VK-2P-45 the control units of the magnetic disk and tape stores and I/O channels are doubled. Together with the common external storage field and the use of various alternative devices (EC 7077, EC 7920), this allows high reliability without significantly increasing the overall price of the equipment.

The VK-2M-45 computer complex is intended for carrying out tasks requiring high reliability. The system consists of two EC 1045 computers supplemented with additional magnetic disk storage, a computer complex control unit, channel adapters and a logical retranslator.

The combining of two computers into a computer complex is organized in three levels:

--at the processor level, by means of direct control features;

--at the common external store field level;

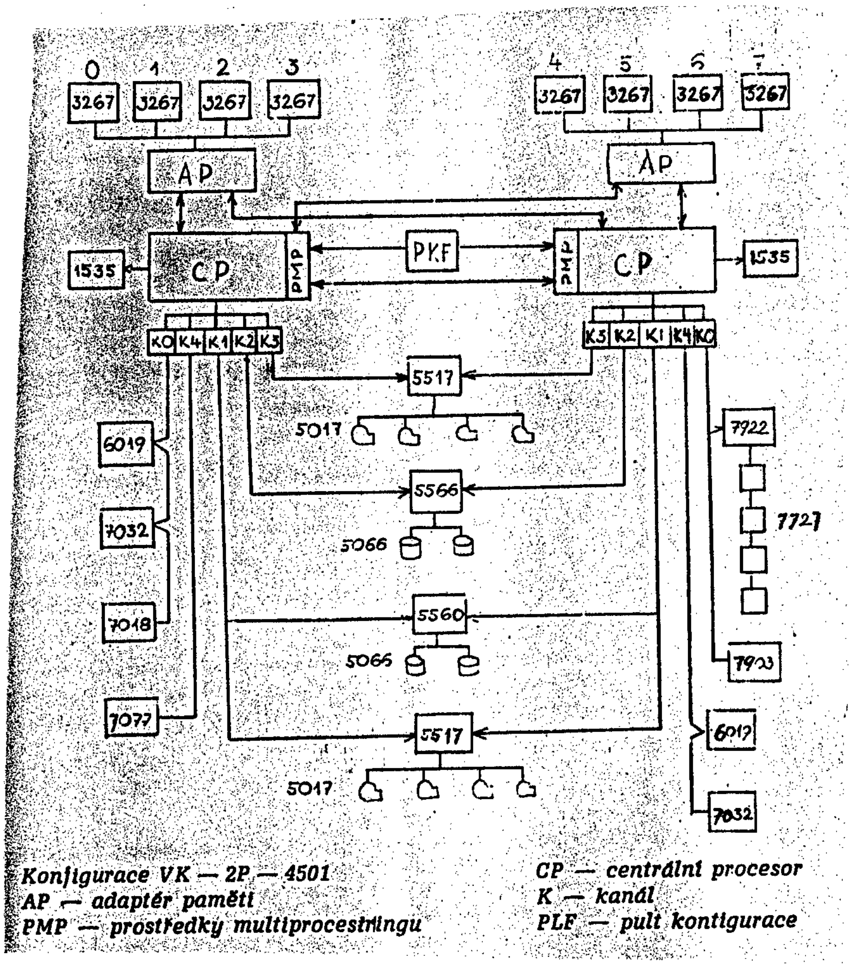
--at the channel level, by means of channel adapters.

The operation of the complex may be organized in the redundant, backup, and task-sharing mode. If one processor is carrying out a specific task, it may

also carry out repairs on the other processor. In addition, the logical translator also creates a special shared field of peripherals which are not backed up within the system of a single computer.

The equipment for organizing a two-processor system used in the VK-2M-45 system effects communication between processors via internal storage. With a modest increase in price, this makes it possible to operate in the two-processor mode with a large system of peripherals. Channel adapters, each with a capacity up to 1.5 Mbyte/sec, allow exchange of information at high speed, not only between computers making up the complex, but also between different complexes of JSEP [Unified System] computers.

The time required to detect and locate malfunctions is cut by a factor of 7 to 8 by a local service system. This system checks the processor of the malfunctioning computer by means of microdiagnostic tests, making use of the nonmalfunctioning computer, which operates under the control of specific versions of the OS/EC operating system.



Configuration of VK-2P-45.01 System

Key: AP, memory adapter
K: channel
PMP: multiprocessing features
CP: central processor
PLF: configuration console

7. Comparison of Standard Configurations of EC 1045 and Computer Complexes

System	EC 1045	CK-2P-45	VK-2M-45
Central processor	1	2	2
Channels	up to 7	12	12
Power supply, including ASKDE checking and diagnostic system	1	2	2
EC 3267 internal store [semiconductor)	1	2	2
Logical retranslator	-	-	2
Channel-channel adapter	-	-	4
Equipment for organizing two-processor system, with configuration console	-	1	1
EC 1535 operator's console	1	2	2
Control console	1	2	2
EC 2500 computer complex control unit	-	-	1
EC 7920 display system	1	1	2
Control card	2	4	4
Motor-generator	1-2	4	4
ML 45 table model magnetic tape store	1	2	2
EC 5017 magnetic tape store	8	8	12
EC 5517 magnetic tape store controller	1	2	2
EC 5066 magnetic disk store	4	4	12
EC 5566 magnetic disk store controller	2	2	4
EC 6019 card reader	2	2	4
EC 7903 punched tape workstation	2	2	2
EC 7010 card punch	1	1	2
EC 7032 line printer	2	2	4
EC 7077 electric typewriter and controller	1	1	2

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BIOGRAPHIC DATA ON NEW ACADEMICIAN LAJOS KESZTHELYI

Budapest NEPSZABADSAG in Hungarian 9 Feb 83 p 5

[Article by Gabor Pal Peto: "A Scientist With Two Homes for Ten Years; Toward a Portrait of a New Academician"]

[Text] Every Tuesday morning a middle aged man arrives in Szeged by express train from Budapest. He goes straight to the Szeged Biological Center (SZBK), and then he is hardly seen in the city, until Friday afternoon when he returns to the "grand station" to return to the capital. Where has he been in the meantime? What is he doing? It is no mystery. In these four days Lajos Keszthelyi, director of the Biophysics Institute of the SZBK (for it is about him that we are talking), has only been working. He stays in a guest room of the SZBK, but he returns there only late in the evening, to sleep. Until then he is in the laboratory or in his office; and he is working there again early in the morning.

He has been living this "two home" life for 10 years, since he was invited to the Biophysics Institute of the SZBK in 1973, soon becoming director of it. Thirty graduate scientific researchers work under his guidance and it is his greatest pride and joy that 25 of them are young people who work with such enthusiasm and interest that it is a pleasure to be with them. This is why he not only tolerates but loves this "two home" life, which means that he spends Monday in Budapest at the Central Physics Research Institute (KFKI), his old place of work, where he also directs a biophysics research group.

You Need Luck Too

This rather curious career began in Kaposvar in 1927. The son of the assistant tailor was one of the most outstanding students of a famous gymnasium, winning virtually every prize, beginning with president of a self-study group, which a student respected by his teachers and fellows could win at that time. He has had his own students since the age of 12. Under the hand of two outstanding teachers of mathematics and physics (Emil Gelleri and Ferenc Tihanyi) his talents developed quickly and everyone thought and recommended that he should take this path also. But since then his career has taken a rather different turn, a higher one.

Lajos Keszthelyi quoted the words of Nobel Prize winner Jeno Wigner, "You need luck in life also". His luck began with the fact that Albert Gyergyai was his graduation chairman. He was a professor at the Eotvos College and through his intervention Keszthelyi could continue his studies there.

Nor did luck desert him after that. There was such a great need for experts at the time of the First 5-Year Plan that they temporarily reduced the university study time to 4 years and he got his teaching degree in mathematics and physics at the time they were forming the Central Physics Research Institute of the Academy and, as a last year student, he was selected to work there. At the same time he was working as a lab assistant at the university. One day they said to him, to go to a hall on the same floor where a committee selecting postgraduate students was hearing applicants. He had not yet applied, but still he became a postgraduate student.

He built a scintillation counter and used it to measure gamma ray absorption, thus winning his candidate's degree in 1955. Then--with no little luck again! --he entered the KFKI in the nuclear physics "department" of Karoly Simonyi where he built a new device, a particle accelerator, and did the first measurements with this cascade generator.

(There is an additional piquancy to the history of the scintillator. When his wife--at once a classmate and faculty colleague--went from the university to the Gamma Works she introduced the scintillation measurement technique and is now dealing with manufacture of detectors for scintillation chambers used for medical purposes and thus, as it were, she is continuing the work of her husband--naturally, on an industrial scale.)

He also had "luck" with his work at the KFKI (although, obviously, it was more than luck); he won the title of doctor of physical sciences at the age of 35.

The "Not Pure" Nuclear Physics

As he says, he was always interested not only in "pure" nuclear physics but also in the "not pure" version, by which he means that he was always happy to deal with the application of nuclear physics methods to other areas. This is how he got involved with the Mossbauer effect too. He noticed very early at the KFKI the method described by the FRG scientist in his doctoral dissertation(!) for which he soon won the Nobel Prize. It became an interesting "by-product" of the application of this method that since then the KFKI has been manufacturing and marketing Mossbauer equipment. But there was another not insignificant by-product also. He needed a multi-channel analyzer, his measurements required the sensing and processing of many data, and he began to develop one at the KFKI on the model of the "Raduga" imported from the Soviet Union. This finally developed into the TPA, the internationally recognized small computer of the KFKI.

It is not easy to describe another "not pure" nuclear physics project. Lajos Keszthelyi became internationally famous with the perturbed angular correlation method for measuring the magnetic momentum of excited states of atomic nuclei. This led to his invitation to a conference in California in 1967 and to a one year guest researcher invitation to McMaster's University in Hamilton (Canada).

He was dealing with the use of nuclear physics methods in microelectronics research at the KFKI when he was invited to Szeged, precisely because of the interest in and achievements of the applications of nuclear physics methods. He was to join in a very interesting theme. In 1956, when Lee and Yang, two American physicists of Chinese origin, discovered the asymmetry of elementary particles, for which they were awarded the Nobel Prize, the idea occurred to biologists that this phenomenon might explain the well known asymmetry of the living world, that living organisms contain only one of the two possible spatial variants of amino acids. This research was conducted in a number of places, accompanied by great debates, because the experimental results of different laboratories were very contradictory.

To Know When to Quit

A physicist among the biologists.... Lajos Keszthelyi reviewed the experiment, pointed out their weak points, and demonstrated on theoretical grounds that a difference of at most a hundred millionth billionths (10^{-8} -10^{-9}) could be expected between the amounts of the two types of amino acid as a result of the asymmetry of elementary particles. There is no causal mechanism known in nature which would amplify this tiny asymmetry. He summed up the question in an article which appeared in the international journal ORIGIN OF LIFE with the conclusion that a causal relationship between the two types of asymmetry (in elementary particles and in the living world) was very improbable. Research on the theme ended at the Szeged Institute. Often this is the most difficult thing in science, to abandon something.

Bioenergetics--this is the key word in the Biophysics Institute of the SZBK now. Using solar energy is only part of it but it is very essential because it belongs to the field of applied biophysics and provides the foundation for basic research (and the material side). For example, they are also dealing with the transformation into hydrogen of the sugar content of molasses.

Very exciting basic science research is taking place in the Biophysics Institute at the same time. Zsolt Dancshazi, a young and promising colleague, brought from the Soviet Union a strain of bacteria in the wall of the membrane of which there is a protein very similar to the rhodopsin in the human eye. It produces electric energy under the influence of light. They are studying the extraordinarily complex mechanism of the functioning of the enzymes in the cell wall, thus elaborating a theory for which the English scientist Mitchell won the Nobel Prize. It is true that in this work one must take the view of a physicist, which biologists find a little difficult, but the results are slowly bringing the general attitude around....

This is how the new corresponding member of the Academy, elected in 1982, works, teaches and studies in his rather uncustomary "two home" life. His relaxation and amusement may be a good book or a good soccer match on television (both rather rare) and that "interdisciplinary further training" in which teachers in various fields, teaching in Szeged and going home to Budapest weekly, participate on the train. This is giving birth to a new Hungarian literature also, as the literary types are "studying" physics and biology at the express train university.

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ROMANIA

TREATMENT OF COMPLICATIONS IN ORGANOPHOSPHOROUS POISONINGS

Bucharest REVISTA SANITARA MILITARA in Romanian No 3 (Jul-Aug-Sep) 82 pp 299-303

[Article by Med. Dr. Col. Tudor Toma]

[Text] Major evolutive complications (disturbances of myocardial excitability and conduction, convulsive crises, acute toxic pulmonary edema), that appeared after acute poisoning with organophosphorous compounds, require specific intensive therapeutical procedures.

The experience of the clinical toxicology collective demonstrates the effectiveness of using xylene, propranolol and/or electric defibrillation in the case of troubles of myocardial excitability. Consecutive congestive cardiac insufficiency requires cautious digitalization or use of glucagon. Progressive bradycardia, refractory to atropine, responds to dopamine or endocavitary stimulation. Cardiac arrest calls for intracardiac administration of antidotes. The convulsive crisis is controllable with antidepolarizing myorelaxants. Toxic acute pulmonary edema requires antidotic, tonicardiac, diuretic and anti-imflammatory treatment. Totally contraindicated is the use of carbamates, depolarizing myorelaxants, aminophylline and opiates.

The picture of poisoning with organophosphorous compounds (OPC) is well outlined in human clinic by the greater incidence of voluntary or accidental acute poisoning, with this kind of substances and specifically pesticides.

Moreover, the mechanism of action of these compounds is known, the symptomatology is well labeled and the treatment is largely standardized.

However, some aspects of OPC toxodynamia are less known, especially if we have in mind the effects that are independent of acetylcholine excess.

Recently, a growing number of authors have been trying to experimentally demonstrate the intimate mechanisms with respect to the direct action on the cellular enzymatic equipment, specifically that of adenosine triphosphate in the muscle fiber, the modifications in the permeability of the cell membrane, of the mechanism of proteic phosphorylation, of inhibition of proteinkinase, a process that is similar to that of the inhibition of Ak. E., and so forth.

These brief specifications serve to emphasize that some severe complications of OPC poisonings such as disturbances of myocardial excitability and conduction, which in

recent years have been more and more frequent, seem to be produced by the direct OPC mechanism on the adult and embryonic myocardium.

This may help to explain the observations of many authors and the observations from our experience, that in most cases the serious rhythm disturbances appear at an interval of several days, when the patients' condition starts improving and serum pseudocholinesterase rose significantly and the treatment of cholinesterase with atropine and reactivators does not favorably impact on these disturbances.

These specifications also serve to back the need for further research in this area, for the purpose of developing a new, more complex, antidote, with a possibly omnivalent action, that would prevent or combat also the above complications.

The data obtained as a result of experimental studies and detailed clinical observations constitute the factual material, which, besides the informational one, permits to establish treatment principles and methods for preventing and combating the effects of the possible use of neuroparalytic substances on the battlefield. This, all the more so because it being a strategic military element, along with other toxic substances, it constitutes, in spite of all the measures taken at the UN and within the framework of other conventions, a peril to the security of nations.

We shall briefly describe our experience regarding the measures and procedures for treatment of major complications found in OPC poisonings.

In regard to cardiocirculatory complications in the evolution of patients with OPC poisonings, we noted disturbances of myocardial excitability, manifested by supraventricular tachycardias, mono- or poly-focal ventricular extrasystoles, paroxystic tachycardia, ventricular fibrillation, which most frequently induce the final cardiac arrest.

Such complications generated by greater myocardial excitability have responded well to administration of xyline or propanolol.

Xylene was administered on a continuous basis by using either parallel perfusion or the injectomate.

In this kind of complications, the doses were surprinsingly variable, that is between 0.5 and 6 g/24 hours, depending on the response of the myocardium.

If, under perfusion with xylene, the monitor showed the reappearance of extrasystoles or images of ventricular tachycardia, we used, in parallel, propanolol in unique doses of 1 mg, repeaded if necessary. The doses of propanolol ranged between 5-20 mg/24 hours.

We had reservations regarding this drug when the manifestations of cardiac insufficiency and especially the appearance of premonitory signs of another serious complication, acute pulmonary edema, occurred.

In case the use of antirhythmic drugs did not prove to be effective, especially in the severe forms of rhythm disturbances (ventricular paroxystic tachycardia and ventricular fibrillation), we resorted to electric defibrillation under the protection of xylene.

In all these cases we paid much attention to the patient's oxygenation, in light of the special sensitiveness of the myocardium to hypoxia and, consequently, the appearance and maintenance of excitability disturbances.

Depending on the condition of the patient, oxygenation involved the use of a nasal sound or mechanical ventilation with orotracheal intubation, a procedure which in some cases resulted in suppression of the rhythm disturbances.

A very severe complication in the evolution of OPC poisonings involves the coexistence of the rhythm disturbances with the onset of cardiac insufficiency, translated by arterial hypotension, elevated central venous pressure and, as a final sequence, acute pulmonary edema.

The difficulty of combating such a complication lies in the fact that the utilization of tonicardiacs of the digitalic type increases myocardial excitability.

In these cases, proper oxygenation of the patient under antiarrhythmic protection, with good monitoring and specialized assistance involving the presence of a versed reanimator, have permitted cautious administration of doses of digitalis with good results in most cases.

In cases when the contraindication of digitalis was certain, glucagon was administered with results that not always were favorable.

A less frequent rhythm disturbance involves the onset of progressive bradycardia which is refractory to atropine administration, with a usually lethal evolution.

The attempt to administer isuprel-type betastimulants is coupled with the risk of inducing ventricular fibrillation.

Encouraging results were provided by endocavitary stimulation or administration of dopamine which involves a minimal risk, versus betastimulants.

In these patients, with a lesser frequency, conduction disturbances are noted, generated by the direct action of the poison on the embryonic myocardium. Also found were intraatrial blocks, atrioventricular dissociations, intraventricular blocks, and so forth.

The coexistence of excitability disturbances is frequent and in these situations the administration of xylene was very useful.

In spite of the measures taken in a section of intensive monitoring, with adequate equipment and specialized care, mortality caused by cardiac rhythm disturbances in acute OPC poisonings is nevertheless acute.

We believe that prognostic in the future can be improved either by the development of a more complex antidote or by the utilization, as a rule, of an endocavitary catheter at the onset of the first rhythm disturbances. When the antiarrhythmics used do no longer prove their effectiveness, it is necessary to promptly apply electric stimulation.

The sequences in the reanimation of the cardiac arrest induced by OPC poisoning are the known ones, with the specification that the order of the procedures must be used concomitantly with the administration of atropine and intracardiac reactivator (500 mg toxogonin + 10 mg atropine) prior to administration of adrenaline or calcium, all this after use of mechanical ventilation with external massage and perfusion of alkalinizing solutions.

We list among severe respiratory complications the onset of acute pulmonary edema.

In the case of OPC poisonings, as a rule the phenomena disappear after administration of atropine and reactivators.

If the phenomena do not disappear after the administration of the antidotic treatment use will be made of antifoam aerosols (alcohol 12%, polyxyloxan 10%), tonicardiacs, glucocorticoids in large doses (500-1000 mg), diuretics, tracheal intubation, mechanical ventilation with expiratory brake (PEEP), and so on.

A severe complication involves convulsive crises. After administration of atropine, with the improvement of the clinical picture, the phenomena decrease in intensity or even disappear. If they do not disappear, used are small and fractioned doses of barbiturate with short action administered intravenously. In severe cases perfusion with xylene potentiated with diazepam may be used.

Sometimes, relapses are observed, with the reappearance of the characteristic symptomatology, or the reoccurrence of one of the major complications mentioned above. In the case of relapses, when the patients repeat one of the three initial syndromes: muscarinic, nicotinic or central-nervous, atropine and reactivator, in adequate doses, will be used.

In the case of relapses, where the aggressiveness of the general condition precipitates, with the appearance of one of the major complications mentioned above, the sequence of the therapeutical measures specified at the time of their description is repeated.

The procedure of reanimation in severe OPC poisonings indicates that the two major complications -- convulsive crisis and acute pulmonary edema -- which succeed each other or occur simultaneously, pose special problems because in the absence of competent and intensive action their evolution in most cases is lethal.

In these situations, the succession of the stages ought to be as follows:

1. Swift clinical diagnosing (clinical, anamnestic signs, tolerance test for atropine, and so on);

2. Prompt transportation, under qualified supervision, to an intensive care unit;

3. Administration of atropine and toxogonin (usually 10 mg atropine + 500 mg toxogonin or one vial atox intravenously) if possible at the scene of the accident or during transportation;

4. Manual ventilation with positive pressure, using the Ruben bag and preparation of what is needed for intubation (laryngoscope, tracheal tube, and so on);

5. Administration of a competitive relaxant (pavulon 6-8 mg or flaxedil 100-120 mg);

6. Tracheal intubation and respiratory prosthesis using, as a rule, a ventilator with an expiratory brake device (PEEP);

7. Supplementation of the atropine dose, according to the clinical signs;

8. Electrocardiographic monitoring;

9. Administration of alkaline solutions (THAM 100-150 ml or a bicarbonate solution M/2-200-250 ml);

In acute pulmonary edema a major cardiac tonic with rapid action is administered from the beginning (0.3 mg strophanthin which is repeated after 20-30', Isolanide or Lanatoside C 0.4 mg, reinjected after 40-60'), hydrocortisone hemisuccinate 300-500 mg and a diuretic (Furosemide).

All the other complications (secondary infectious syndrome, disorders of the hydro-electrolytic, acidobasic, fluidocoagulant, metabolic and immune balance) whose determinism is not immediately tied to the action of OPC and which set in after the patient has overcome the critical situations that are characteristic of OPC poisoning, will be combated in accordance with the usual therapeutical charts, depending on the scale and preponderance of symptomatology.

Not for a moment, under the conditions and the sequences of intensive treatment in OPC poisonings, should we omit the incompabilities in the entire therapeutical arsenal mentioned above, notably, the absolute contraindication of administration of:

a. Carbamates (neostigmine, mintacol, and the like) -- the substances with anticholinesterase effect;

b. Depolarizing myorelaxants (succinylcholine, decamethonium, and so on);

c. Aminophylline, opiates and their derivatives.

We succintly described the current treatment of major complications in OPC poisonings rigorously expressing our experience, in our firm belief that in providing specialists in this field with these therapeutical methods and sequences we shall combine our efforts to reduce lethality in these poisonings in peacetime, with applicable results under field conditions.

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